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LUME 32, No. 21

AMERICAN DYESTUFF REPORTER

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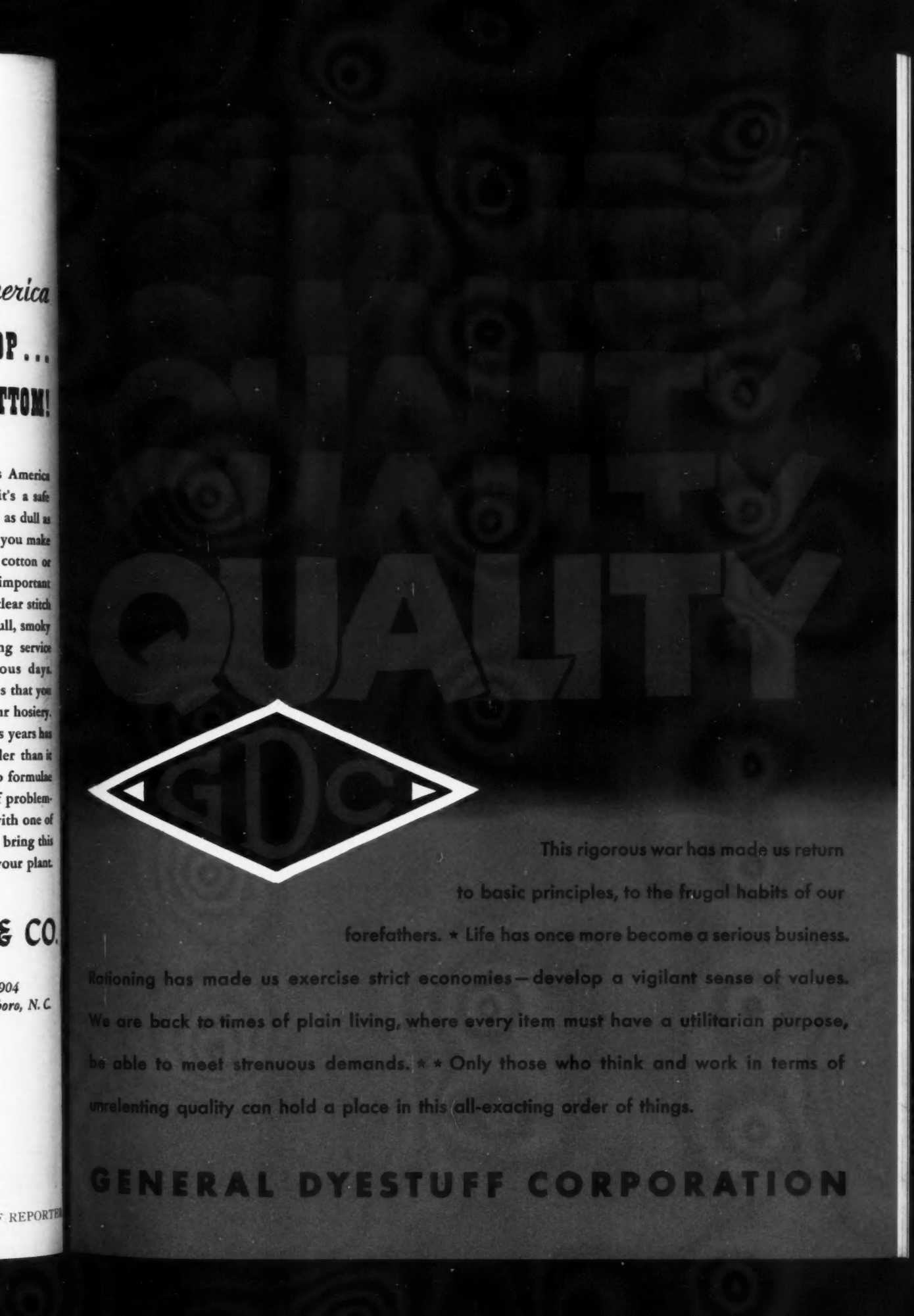
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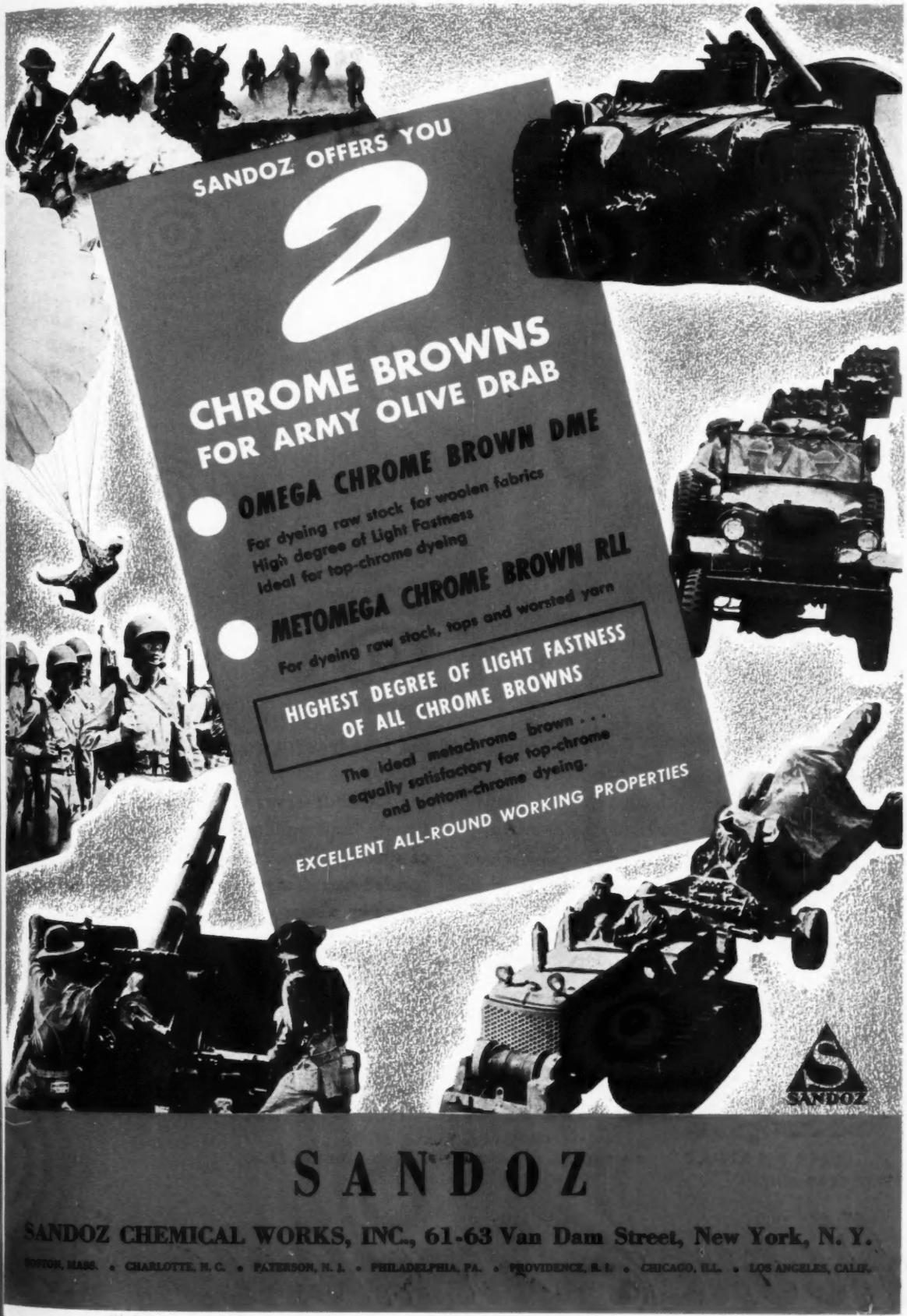
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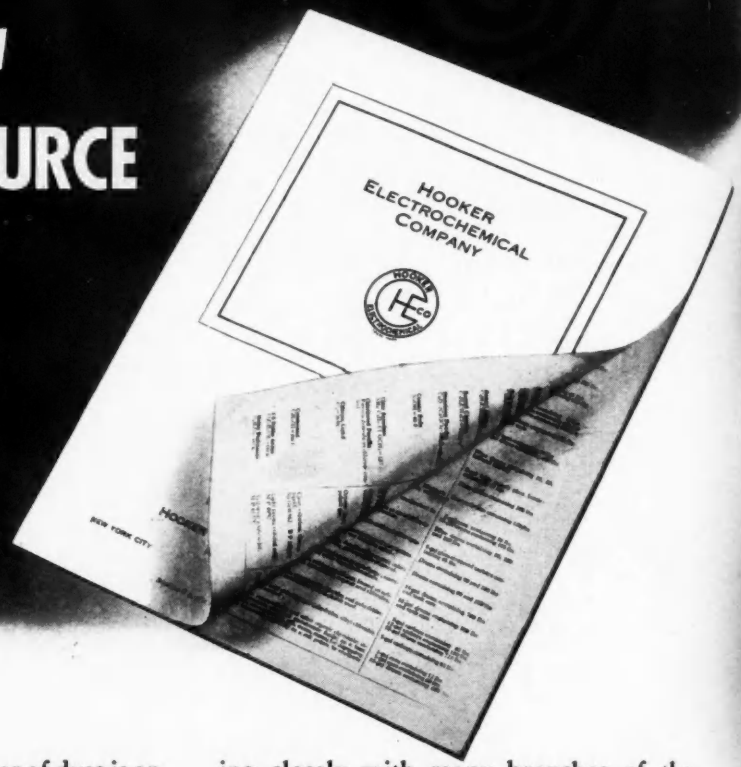

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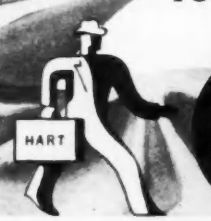

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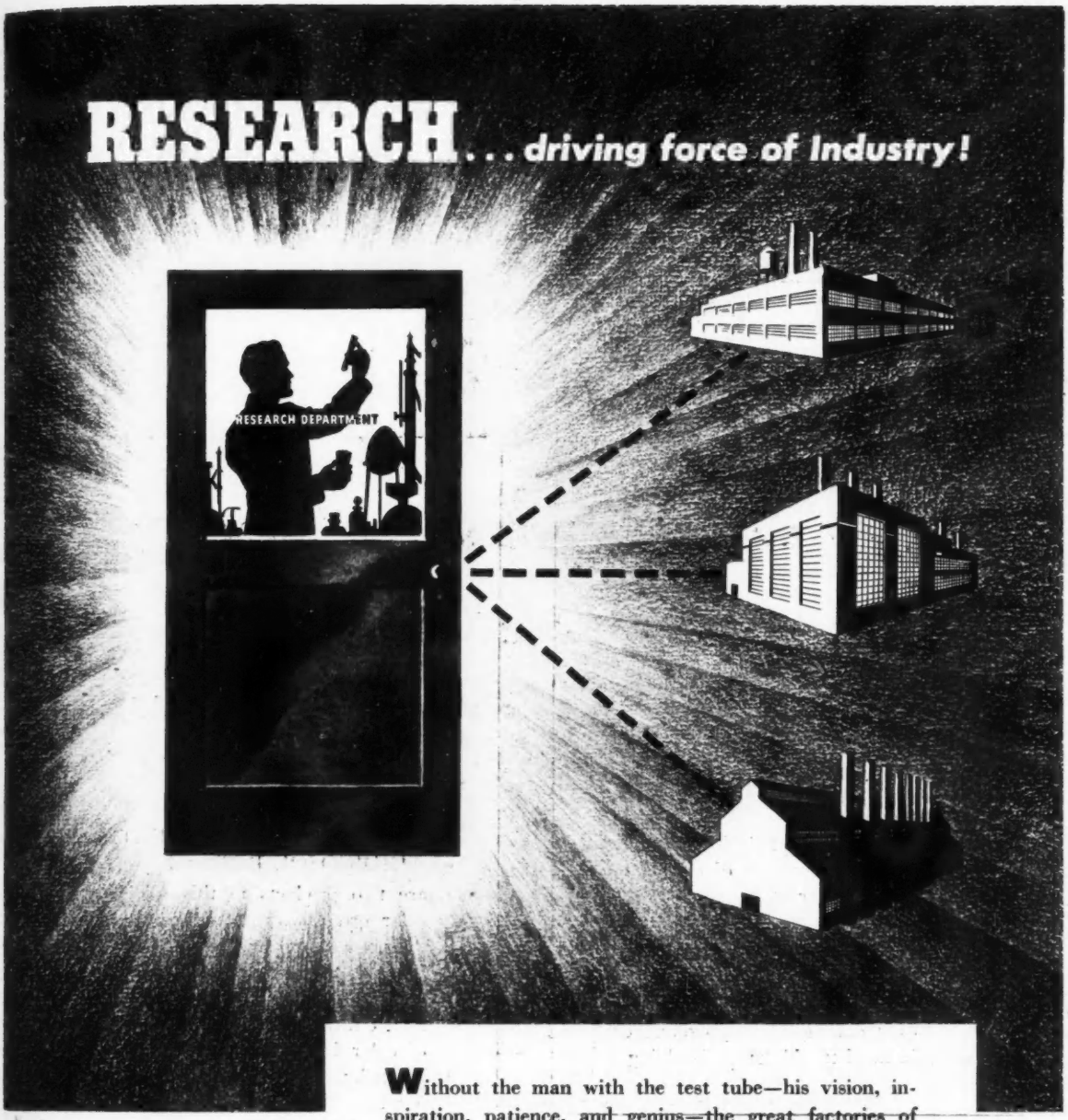

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OCTOBER 11, 1943

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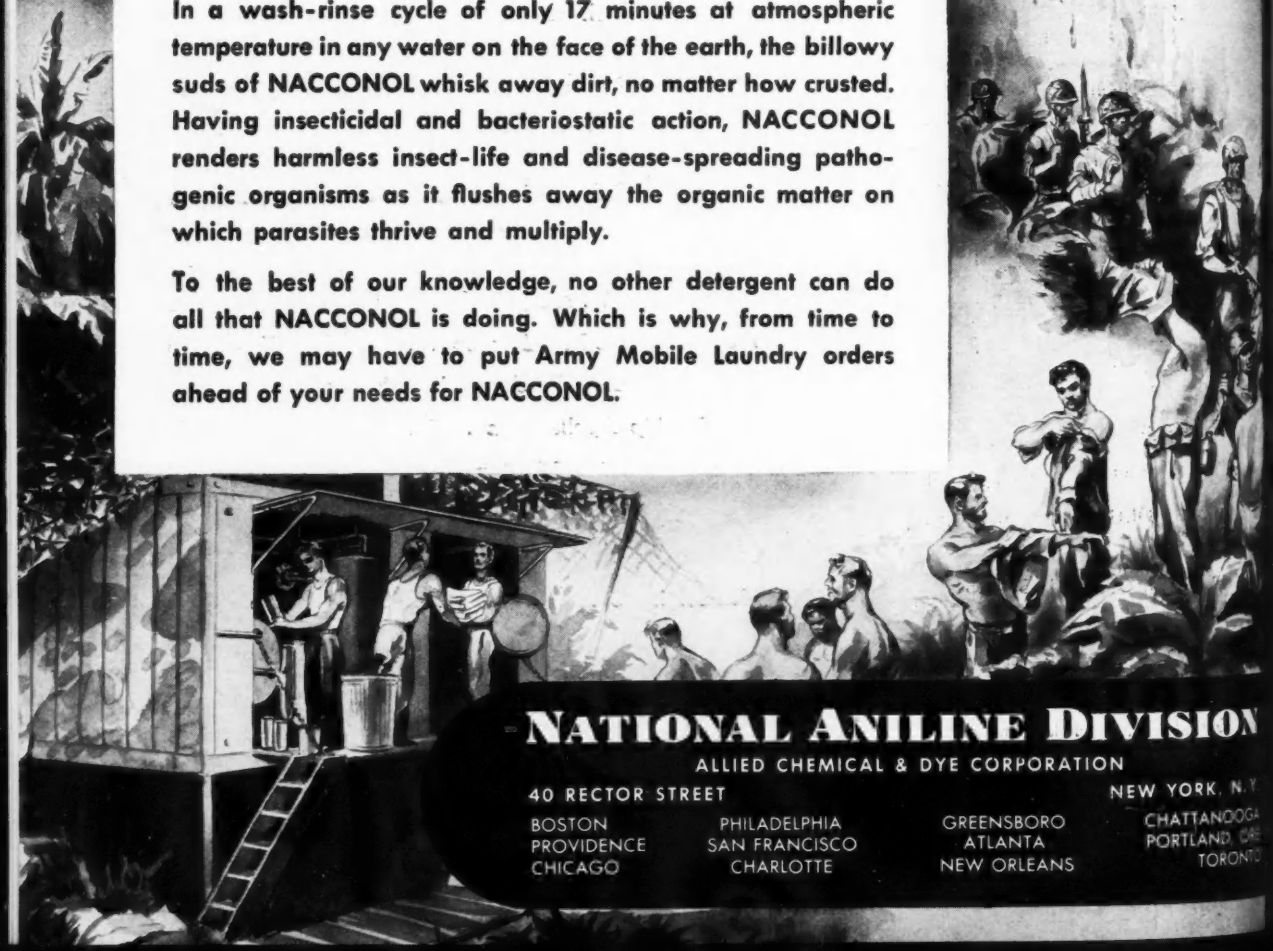

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AMERICAN
DYESTUFF REPORTER
VOLUME 32 OCTOBER 11, 1943 NUMBER 21

STRUCTURE OF THE WOOL FIBER

as Revealed by the Electron Microscope

CHARLES W. HOCK* and HOWARD F. McMURDIE**

ABSTRACT

An investigation of the wool fiber with the electron microscope was undertaken in order to get more data on the structure of the fiber and its constituent cells, and to correlate this information with results previously obtained by other methods. Specimens were prepared for examination by various physical and chemical procedures.

Over a wide range of magnifications the cortical cells always showed a distinctly fibrous structure. Whereas with the optical microscope only fibrils were observed within the cortical cells, the higher resolving power of the electron microscope made possible the resolution of still finer microfibrils. The scale cells, on the other hand, showed little internal organization. This difference in structure between the fibrous cortex and the non-fibrous or amorphous cuticle, is believed to be of fundamental importance in interpreting many of the properties of the fibers.

I. INTRODUCTION

WOOL fibers are not simple homogeneous structures but consist of various parts and layers which become apparent under suitable conditions of observation. Thus, a growing wool hair is found to have a bulbous root situated below the surface of the skin, and a filamentous shaft which extends above the skin surface. The shaft, in turn, is made up of dead cellular units which are arranged in three layers—an outer layer of scales (cuticle), a middle region called the cortex, and a central core or medulla. The medulla, which in the finest grades of wool is either very narrow or absent altogether, is not believed to contribute appreciably to the mechanical properties of the fibers and, accordingly, attention has been directed largely to an understanding of the structure of the scale and cortical cells. The scales are restricted to a thin layer which constitutes the outer surface of the fiber, whereas the cortex, either in the form of a solid or a hollow cylinder, depending on the extent of medullation, makes up the bulk of the fiber. A more detailed discussion of the microscopy of wool may be found in publications by Kronacher and Lodemann (1)†, von Bergen (2), von Bergen and Kraus (3), Reumuth (4), Müller (5), Hock, Ramsey and Harris (6), and others.

The principal chemical constituent of wool is keratin, a protein consisting essentially of long polypeptide chains connected laterally by disulfide cross-linkages (7, 8, 9, 10, 11). Although both the cuticle and cortex appear to belong to this same general class of proteins, there is abundant evidence from various lines of investigation which indicates that there are, nevertheless, certain differences betwen them. For example, when wool is treated with enzymes the fibers are attacked first at their cut ends, where the enzymes have, presumably, easier access to the fiber. Prolongation of this treatment, moreover, causes the cortical cells to become separated from each other and ultimately released from the fiber, whereas the scales remain practically intact in the form of a hollow tube (6, 12). Similarly, treatment of wool with reagents which cause swelling, such as sodium sulfide, shows that the scales are, as a rule, more resistant than the cells of the cortex (13, 14). Likewise, it has been reported (15) that the passage of solutions of acid dyestuffs into the fiber is resisted by the cuticle. A consideration of staining and dyeing also reveals other differences between the scale and cortical layers. For example, when wool cells which have been separated by acids, alkalis, or enzymes, are treated with dyes such as methylene blue or Orange II, only the cortical cells have any affinity for the stains (16, 17). In like manner the work of Royer and Millson on dyed wool (18) shows that the ends of the fibers, which are not protected by scales, take up dye more rapidly than do intermediate parts of the fiber. This phenomenon is the basis of a number of tests for damage, in which the cortex colors only where previous injury to the scales allows entry of the test reagents (19, 20, 21). A further difference between the

*Research Associate at the National Bureau of Standards, representing the Textile Foundation.
**Division of Clay and Silicate Products, National Bureau of Standards.

†Figures in parentheses indicate the literature references at the end of this paper.

scales and cortical cells is revealed by the Allwörden reaction, in which the scales, unlike the cells of the cortex, swell up into little sacs when the fibers are placed in a saturated aqueous solution of chlorine (*22*).

Detailed information concerning the structure of the various types of wool cells is available as a result of investigations with the optical microscope. Using this technique the principal difference between the cortical cells and the scales lies in the fibrous appearance of the former, and the uniform or amorphous appearance of the latter—a difference which may be of fundamental importance. Since the dissimilarities in chemical composition of the cuticle and cortex are evidently slight (*1, 17, 23, 24, 25*), it seems probable that the differences in behavior of these two regions may be dependent more on physical than on chemical differences. Accordingly, it was thought interesting to note whether dissimilarities in structure are still observable at the high magnifications obtainable with the electron microscope and the present study was undertaken, therefore, to get more data on the structure of the wool fiber and its constituent cells, and to correlate this information with results previously obtained by other methods.

II. APPARATUS AND MATERIALS

1. The Electron Microscope

The electron miscroscope used in this study was the Radio Corporation of America's Type B instrument, having electromagnetic lenses. Its construction and use, as well as that of electron microscopes in general, has already been discussed in various publications (*26, 27*). It is important to recall, however, that the image produced by the electron miscroscope is the result of absorption and scattering of the electron beam, and that these effects are, in turn, a function of the density and thickness of the object. The electron image is, thus, a result of differences in the amount and kind of mater traversed by the electrons, and is not produced by differences in refractive index as is usually the case in photomicrography.

Considerable caution must be exercised in interpreting electronmicrographs. Since the instrument is evacuated during use, drying of the specimens ensues, and this may bring about changes in structure, particularly in biological specimens. Furthermore, organic materials are sometimes disintegrated by the electrons, especially where thick sections absorb large amounts of electron energy. These, as well as other possible alterations which may occur during the preparation of the specimens for examination, should be borne clearly in mind.

2. Samples of Wool

In order to have observations on a fairly representative number of wools, five different samples were used in the investigation. One sample of fine merino wool was the same as that used previously in this laboratory. It was purified by extractions with ethyl alcohol and with ether for 16 hours each, followed by washing with water at 40° C. The remaining wools had been given commercial degreasing treatments and were used just as received.

III. PREPARATION OF SPECIMENS

For a satisfactory examination with the electron microscope, specimens should not be more than a few tenths of a micron thick. Unfortunately, the finest wool fibers do not even approach this limit, so that various means must be used to obtain sections suitable for examination. Inasmuch as the methods of preparation may bring about changes in the structure of the specimens themselves, it seemed likely that the best understanding of the wool cells could be achieved by the examination of specimens which had been prepared by a variety of chemical and physical procedures. In the present investigation specimens were prepared by the following four methods.

1. Untreated* and undamaged wool reacts slowly to enzymes, but it is unusually susceptible to attack if, for example, the disulfide cross-linkages have been ruptured by reduction with thioglycolic acid and then methylated to prevent reformation of the linkages (*12*). After treatment with pepsin for several days to a week, cortical and scale cells are released from the wool fibers. For the present work, cells obtained by this procedure were washed repeatedly with distilled water until the suspension was neutral, whereupon a drop of the suspension was placed on the specimen holder of the microscope and allowed to dry. The scales were less than 0.5 micron in thickness and hence satisfactory for examination with the electron microscope. The cortical cells were too thick to allow passage of the electrons except at their tapering ends, and accordingly observations were confined principally to these regions.

2. Another method for obtaining scales for examination with the electron microscope involved treating the fibers with acid. Wool fibers were placed either in concentrated sulfuric acid for several hours or in concentrated formic acid for several weeks. This treatment loosened the scales and caused them to bend away from the fiber so as to resemble warped shingles on a roof. By subsequent agitation of the acid-treated fibers in a small amount of water many scales and fragments thereof were removed. The released scales were washed with distilled water until neutral, and then examined in the usual manner. Although it is recognized that the acid treatment probably brings about changes in the structure of the scales, it is interesting to note that scales treated in this way still form Allwörden sacs when they are placed in chlorine water (*6*).

3. Mechanical separation of the scales from the fibers was accomplished by the method of King (*28*). After attaching a weight to the fiber to keep it taut the fiber was drawn across the edge of an ordinary glass slide mounted horizontally. In this way thin slivers were scraped off, and these sometimes appeared to consist solely of scale material.

4. Another method for obtaining scales by mechanical action involved the use of a Wiley mill. In this machine the fibers are cut lengthwise into rather long pieces which are, of course, too large and thick for examination. However, as the fibers pass through the mill pieces of scale material are also broken and chipped from the surface of the

*In this discussion wool fibers which receive no specific chemical treatments before being placed in enzymes will be designated *untreated* wool, whereas the fibers which were reduced and methylated before being subjected to the action of enzymes will be called *treated* wool.

Fig. 1—Group of scales released by the action of pepsin on treated wool fibers. Stained with Orange II. Photomicrograph x 1500

Fig. 2—Part of a scale, released from treated wool by pepsin, showing its mottled appearance and fimbriate margin. Electronmicrograph x 16,000

fibers, and these fragments are suitable for use. In the microscope the thin scales were easily distinguished from the thick and dense pieces of fiber. Also, satisfactory specimens of cortical material were prepared by triturating the coarse powder from the mill between two pieces of ground glass.

IV. RESULTS AND DISCUSSION

1. Structure of the Scale Cells

Scales from five different samples of wool were examined at several magnifications. Although the structural pattern varied depending on differences in experimental technique, all the scales, regardless of the method of preparation or of the samples from which they came, showed certain similarities. For example, the margin of the distal part of the scale, i.e., the part away from the point of attachment and not covered by overlapping scales, was relatively thick and dense, and hence showed little evidence of a finer structure. The proximal end of the scale, on the other hand, was thin enough to allow passage of the electrons and thereby reveal details. Thus, the scale as a whole is evidently wedge-shaped, decreasing in thickness from its distal to its proximal end.

The scales, unlike the cortical cells, show little internal organization even at the highest magnifications obtainable with the optical microscope. Usually this instrument shows clearly that the scales overlap in a manner comparable to that of shingles on a roof, but there is almost no indication of a pattern within the scales themselves (figure 1). The higher resolving power of the electron microscope, however, does reveal a pattern in scales released by certain procedures. For example, figure 2 is an electronmicrograph of part of a scale which had been prepared in exactly the same way as the scales photographed in figure 1. The greater detail of the electronmicrograph is evident, the scales appearing rather mottled, with less dense areas scattered throughout the denser regions. These less dense areas were irregular in shape, and varied in size up to about 1 micron. Generally speaking all the scales separated from the fibers by chemical action had this mottled appearance. Specimens which were prepared by identical procedures did not, however, always have exactly the same appearance. Thus, although the scales obtained by treatment with sulfuric acid usually had a typical mottled appearance (figure 3,a), occasionally they exhibited a more porous or vesiculate pattern (figure 3,b). Likewise, the scales released by the action of untreated wool with pepsin often had the typical appearance of chemically-released scales (figure 4,a). Frequently, however, they underwent disintegration by the electrons, and then presented an appearance as shown in figure 4,b.

Mechanically-removed scales showed less structure than those separated by chemical techniques. At magnifications of only several thousand times they appeared uniform with little indication of a finer structure. Sometimes at higher magnifications a faint pattern was discernible (figure 5,a), but usually they still appeared structureless (figure 5,b). For a number of reasons it seems likely that the relatively

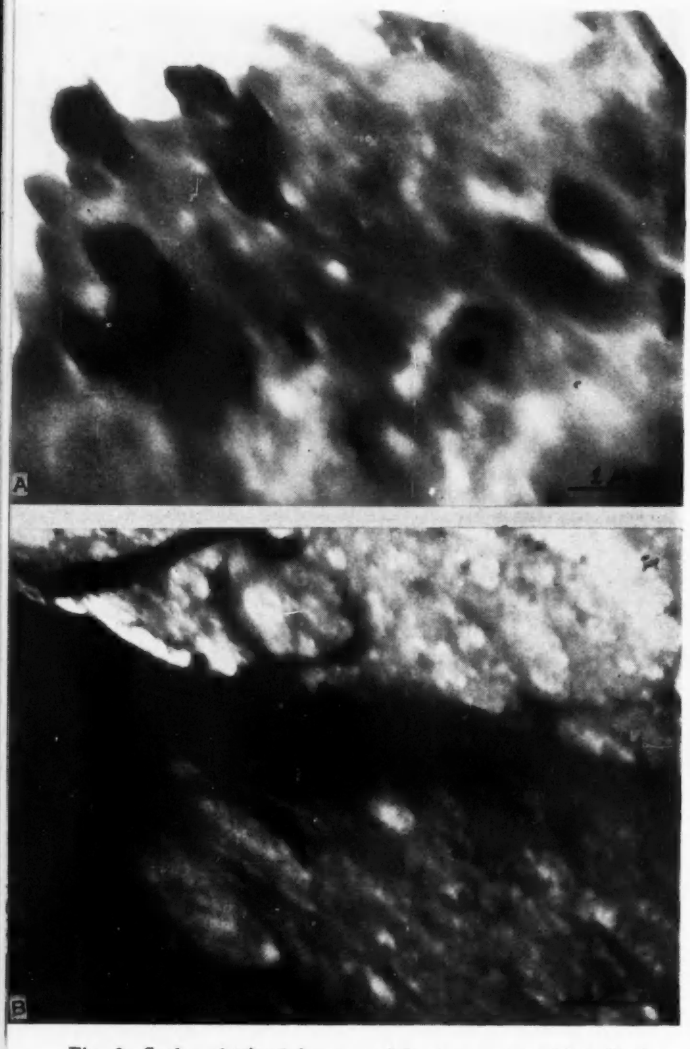

Fig. 3—Scales obtained from wool by treatment with sulfuric acid.
(a) Proximal end of scale, having a mottled appearance. Electronmicrograph x 14,500
(b) Parts of several adjoining scales showing a vesiculate structure. Electronmicrograph x 15,500

uniform and amorphous appearance of these scales approaches more closely the true structure than that observed in chemically-released specimens. In the first place, mechanical action would seem to be less drastic than that of chemicals. Probably more significant, however, is the fact that indirect evidence from other lines of investigation suggest a type of structure with which that observed in the mechanically-removed specimens is in agreement. For example observations with the polarizing microscope reveal that, unlike the cortical cells which are anisotropic, the scales have little if any birefringence (6). Similarly, X-ray data by Astbury and Street (29) show that the X-ray spectrum of the cuticle, especially in the stretched condition, differs from that of the whole fiber, and suggests a more or less random orientation in the former. The stable

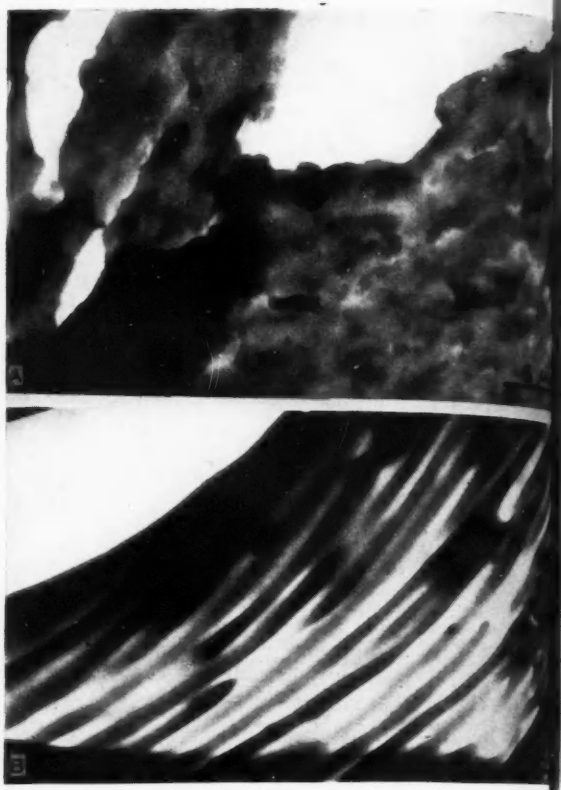

Fig. 4—Scales released from untreated wool by pepsin.
(a) Part of scale showing a mottled appearance.
(b) Part of scale which has undergone disintegration by the electrons.
Electronmicrograph x 15,500

nature of the scale material to dyes, swelling agents, enzymes and many other reagents, has already been pointed out, and is, likewise, compatible with the present observations.

2. Structure of the Cortical Cells

The examination of cortical cells with the electron microscope confirmed and extended the results previously obtained with the optical microscope. With the latter instrument it has been shown that cortical cells are spindle-shaped and that they have a striated appearance, except for a granular nucleus near their center (figure 6, a). That the cells are fundamentally of fibrous structure, as indicated by their striated appearance, can be verified by dissecting single cortical cells with microneedles, whereupon numerous fibrils can be separated (6). Between crossed nicols the fibrillate part of the cortical cell appears birefringent, whereas the granular nucleus does not (figure 6,b).

Because of their size, observations with the electron microscope of the cortical cells released by pepsin were confined principally to their thin and tapering ends. There are good reasons for believing, however, that, except for the nucleus, they have a similar structure throughout. It

(Continued on page 451)

PROCEEDINGS OF THE

American Association of Textile Chemists and Colorists

OCTOBER 11, 1943

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OPEN FORUM MEETING

Southeastern Section

Reported by ROBERT W. PHILIP

AN OPEN FORUM discussion meeting was held by the Southeastern Section at the Atlanta Athletic Club, Atlanta, Ga., on Saturday evening, ber 18. The attendance included 91 members and guests.

John P. Harrison, general superintendent of Dundee Mills, Inc., Griffin, Ga., presided as chairman of the section. The discussion was in charge of Laurie E. Whittelsey, of Southern Dyestuff Corporation, who is chairman of the program committee.

The subjects discussed dealt mainly with problems induced by the war, and those imminent in the postwar period. There were no prepared papers, the discussion being extemporaneous, covering a list of five questions suggested by members and distributed in advance to the membership.

WOMEN IN FINISHING PLANTS

The first question presented by Mr. Whittelsey was, "How many places, and where, in dyeing, finishing and bleaching, can you replace men with women?" He called on Leslie L. Bamberger, purchasing agent of the Lanett (Ala.) Bleachery & Dye Works.

"I believe it depends largely on what type of fabrics are being handled, particularly as to the weight," replied Mr. Bamberger. "In a finishing plant handling light goods, it seems that a woman could run any operation. In a heavy goods plant, women can run almost any job, with the exception of those involving the handling of heavy batches or boxes. In such a case it would be possible to put in mechanical aids, but lately it has been practically impossible for this industry to get these aids on account of not having sufficiently high priority ratings.

"In our plant (which is a heavy goods plant) I think we have women running everything except dye jigs and mercerizing frames.

"As far as the work done by the women is concerned, it is at least on a par with that of the men, where the matter of strength does not enter into the picture. A woman does have the strength for everything except jobs coming up every now and then for 15 or 20 minute periods, and we have a man to give them a lift at these times, and I think they get along very well. The quality of the work they do is generally good. An exceptionally good woman is better than an exceptionally good man; an average woman is about as good as an average man; and a poor woman is better than a poor man. As far as I know and have heard, I think you can safely say that women have done a very capable job where they have been tried."

George L. Dozier, of Sandoz Chemical Company, treasurer of the section, asked Mr. Bamberger as to the relative amount of absenteeism between men and women workers. Mr. Bamberger said he believes there is less absenteeism among the women workers.

"How about the use of women in package dyehouses?", asked the chairman. R. W. Jones, of Lowell Bleachery, said they can be used for operating machines in the laboratory. He added, however, that "I am afraid we would have more absenteeism on the female end of it."

"One more point," added Mr. Bamberger, "is that women will make better hands on dye weighing and jobs like that. They will keep the scales and other equipment in much better shape than men." He continued by pointing out that obviously women are being used as a temporary measure as a result of the shortage of men, and that a problem will be presented upon the return of former men employees to their places in the industry. He indicated, however, that there will be many places where, if the former men employees do not return for their jobs, plants will continue women on these jobs.

"I do not think there is much place in a rawstock dyehouse for women," said the chairman, "but we would like to have some opinions on this." Curt Mueller, superintendent of dyeing and polishing, Bibb Manufacturing Co., Macon, Ga., agreed with the chairman, pointing out that, in the South, it is customary to use colored male help in rawstock dyehouses. "I am inclined to agree with Mr. Mueller," said Marvin Youngblood, of the dye plant of Callaway Mills, LaGrange. "There is not much place in a rawstock dyehouse for women, except in the clerical end and in the laboratory, because rawstock work is too heavy for women to do.

Robert Lindsey, of the Russell Manufacturing Company's plant at Alexander City, Ala., expressed a contrary belief: that except for rolling the bales of cotton in and out, it would be possible to utilize women in a rawstock dyehouse.

Another member asked about the initiative of women as compared with that of men, and the chairman said, "I think Mr. Bamberger summed that up when he said that the exceptionally good woman is better than the exceptionally good man; the average woman is about as good as the average man; and the poor woman is better than the poor man." H. Gillespie Smith inquired as to the

relative rates of pay and whether, if they are about the same, there is any resentment on the part of the male employees. "The pay is the same for a given task," replied Mr. Bamberger, "and as far as my experience is concerned, there has been very little bad feeling of any kind. In starting it off, it is wise to bring in the wives and other relatives of the men who are already working in the plant. When you first get over the 'shock' of seeing women in the plant, things seem to run very smoothly." He added that in normal times, in the large plant with which he is connected, with the exception of office personnel, there would probably not be over 8 women employed, and these were sewing machine operators, whereas now, as he indicated, women are employed on virtually every operation in the plant except dye jigs and mercerizing frames.

SUBSTITUTE MATERIALS

The second question presented by Mr. Whittelsey asked for discussion on "substitutes for (a) sulfonated castor and olive oils; (b) textile sugars—glucose-dextrin, etc.; and (c) starch." He called on C. M. Stodghill, of Stodghill & Co., Atlanta, Ga., manufacturing chemists, to discuss the first portion of the question.

"As to castor oil," replied Mr. Stodghill, "there is no reason to ask for substitutes, because it is now one of the easiest oils to get. As to olive oil, there is a blend of peanut and soybean oils, hydrogenated sufficiently to saturate it and unsaturate it back partially, and then sulfonated." C. B. Walker, of Charlotte, a visitor from the Piedmont section, expressed the opinion that in discussing substitutes for established products, the use to which they are to be put should be described, for some substitutes are satisfactory for certain uses and unsatisfactory for others. Someone asked Mr. Stodghill about substitutes for tallow, and he replied that, "there is no shortage of inedible tallow, and you can get it if you are on time with your information and reports to Uncle Sam. Of course, edible tallow is off the industrial list."

P. G. Wear, of Penick & Ford, Ltd., Inc., starch manufacturers, was asked to discuss substitutes for textile sugars. He replied that, "I do not know of any logical substitutes, and, in the second place, I did not know they were scarce." The chairman asked for expressions from users, and L. L. Bamberger said that, "our use has been cut down so much as a result of being on government work where they not only don't specify them but prohibit them, that we have been able to get all of the weighting materials we need. I don't say it has been easy, but on account of our curtailed consumption it has been possible to secure our requirements. However, I think present conditions are teaching us something about the use of these materials; you are not giving a man any different finish by using them, all you do is give him more weight, and I think you could give him the same 'feel', etc., with half the amount of corn products."

Substitutes for starch were next covered, and this developed into a discussion of ethyl cellulose products in warp sizing instead of sizing compounds and starch. C. B. Walker said that this is a big field, and there has been considerable progress made in it; that with the process, there is a smaller amount of size added, with equally good results in weaving. Mr. Bamberger asked whether the use of regenerated cellulose on the warp would tend to make the cloth dye a different shade. "So far as I know, 'No' ", replied Mr. Walker. Asked about the cost, he said this has not been determined, but that it appears the cost of the materials added will be lower, but there is a high cost of the initial equipment. "Only one mill that I know of has an experimental slasher on this," reported A. K. Haynes, of Rohm & Haas, Inc. "They had to change over the entire front end of the slasher by adding wash boxes and acid boxes in order to regenerate the cellulose. I understand that it does give you a little different color; if you have other cotton in there it will give a different shade. The main difficulty at present is in getting the equipment to apply it."

"What are the advantages of it over starch?", asked Robert J. McCamy, assistant superintendent, Pepperrell Mfg. Co., Lindale, Ga. Mr. Walker replied that a warp can be dressed with 1½ per cent of this new size; that it provides a permanent finish, and resistance to shrinkage. He added that there is a lot of work yet to be done on the development, but that "it is a coming thing". Mr. Haynes said, "I do not think it will ever be a substitute for starch as such, but in certain cases, and for certain purposes, it does have advantages."

The third question on the questionnaire asked for "a discussion of various methods of dyeing of O. D. No. 7 on herringbone twills." It appeared, however, that between the time the question was submitted and the date of the meeting, government cancellations on this type of work had diminished the interest in it, and there was no discussion of it except a comment from J. E. Smenner, of Eagle & Phenix Mills, Columbus, that so far as he knew, this type of dyeing had not been accomplished on a continuous range.

DYEING RAYON HOSIERY

A discussion of problems in dyeing and finishing viscose and acetate hosiery was next requested. Rufus K. Smith, of Owen Osborne, Inc., Gainsville, Ga., replied that, "The worst problem in dyeing viscose hosiery is in getting the same shade on different lots of rayon yarn, particularly where the mill people make the mistake of making the foot from one lot and the leg from another. We did have a problem also of lines across the stocking, rings like those we used to have from knitting before we put on the three-carrier attachments. In this case it is due to imperfect washing of the viscose yarn, leaving a different dye affinity throughout the cone. That problem has come up just since we have been getting inferior

yarn. The main solution is to treat that with a little caustic soda in the boil-off bath, and use selected dyestuffs that will give more union between the different lots of yarns."

"Would you use caustic in a combination of viscose and acetate?", asked Mr. Whittelsey.

"No," replied Mr. Smith. "A combination of acetate and viscose would probably be an acetate welt and a viscose boot; in that case, I would dye it at 180 degrees F., not pre-boarding, and use dyestuffs that would give as level a dyeing as possible on the viscose yarn. There isn't a lot of goods made with a combination of viscose and acetate. There is one new development which is a cotton and acetate twisted together, and, used in the welt, makes a very nice, tight welt. In that case the answer is to use caustic and saponify the acetate."

"Is it necessary to pre-board hosiery made of acetate?", asked George L. Dozier. "That is a matter of opinion," replied Mr. Smith. "You can dye it and get it through smoothly without pre-boarding provided you keep the temperature down low enough in the dyebath. The main argument for pre-boarding it seems to be the belief that the acetate gets more elasticity as a result of the pre-boarding. Some people seem to feel that the shrinkage that takes place at the pre-boarding results in more elasticity in the hosiery."

DIRECT BLUE "REDUCING"?

There was a brief discussion at this point on a question read by the chairman that was not on the prepared agenda. A member stated that in dyeing a hose made of 50 per cent wool and 50 per cent cotton, he was having difficulty with a fast-to-light direct blue tending to reduce, resulting in off-shade lots. Mr. Youngblood said he did not exactly understand about a direct color reducing, and Mr. Whittelsey said presumably it meant that it tended to take on some of the characteristics of a vat reduction. Rufus K. Smith reported that, "we have found we have some of our browns break down sometimes. It doesn't seem to work like a vat reduction, but some of our brown shades break down toward the yellow, and we have to catch up with it with red. We have put in a little potassium dichromate that has a tendency to hold it down."

Henry Dozier reported a similar difficulty with a particular type of blue, in package dyeing; he said it was no particular make of dyestuff as its prototypes would do the same. He said, "you dye this blue and dry the yarn and the blue is more or less on the red side, and when you get the moisture regain in it, it goes back to the green side of the blue." He told of one order on which he did not put the yarn in the conditioning room, and in winding up, the outside of the cone had picked up moisture but the inside did not and the yarn there stayed on the red side, making an uneven package. He took it back and re-wound it and put it in the conditioning room the other way and it did go back to the original shade of the blue. He said you should get the moisture regain in there to start with to get an even dyeing.

Getting back to the original problem, the opinion was expressed that the breaking down was due, not so much to the presence of the two types of fibers as to the heat or pressure and prolonged boiling.

POSTWAR FIBERS—COLORS—FINISHES

The final question asked for " a discussion of postwar dyeing and finishing problems: (a) fibers, (b) colors, and (c) finishes."

W. B. Griffin, of Kali Manufacturing Co., was asked to discuss impending developments in fibers. "In considering the so-called postwar fibers that we must deal with," he said, "I think it would be interesting to study the development of synthetic fibers in this country. Beginning about 1911, the production of synthetic fibers, rayon, was approximately 360,000 pounds. The development was apparently slow for a while, and then it gained momentum, until by 1920 the production had passed 10,000,000 pounds. In 1942, the production of viscose, cuprammonium and acetate-cellulose rayon was 632,000,000 pounds. So, checking what we can expect of the future by that kind of progress, it is something to think about. I feel sure every gentleman in the room had his part in the development of rayon and the problems it brought. We remember when it was so weak when wet that you could hardly handle it, and so bright and shiny that it was like a glass fiber. And we have watched the progress in dulling rayon and in bringing the strength up. When we compare the original rayon with what we have now, the progress is amazing.

"Then we are all familiar with nylon, the baby of the synthetic fiber family. The production last year was around 20,000,000 pounds, and though all of that fiber is being taken for war purposes now, there is a hungry market waiting for it when it is available to industry.

"Then we have Vinyon, and Vinyon-E, and Velon, a resin-type fiber. These fibers have unusual characteristics in that they are flameproof, you can almost say fireproof, and they are also waterproof, and these properties can be varied as desired. They do not support the growth of mildew or mold—in fact so many things are claimed for them that we will have to have the claims verified.

"Then there are the protein type fibers, the best known of which is Aralac, made from the casein in skim milk; and synthetic wools—there again the claims will have to be confirmed. The claims say that soy bean fiber is warmer than wool. The production of soy bean fiber is about 2,000,000 pounds; of Aralac, about 10,000,000.

"And then we have Fiberglas.

"These fibers are all new, but rayon was not so many years ago. We can be very sure that the production of these fibers will increase in volume and that they will become important factors in the textile industry. Some of the synthetic fibers have been developed with prop-

erties that some of the natural fibers do not have; strength, for instance. Then they become a competitor of cotton, and the cotton people have done a wonderful work in bringing up the strength of cotton, such as by wet-twisting, adding synthetic resins, etc.

"We must get acquainted with these new fibers and realize they are here with us and that they will continue to grow in importance."

"We certainly cannot discount the growth of the synthetic fibers," agreed Robert J. McCamy, who then asked whether cut rayon staple can be successfully handled in a rawstock dyeing machine. Marvin Youngblood said, "It has been successfully dyed on rawstock dyeing equipment. We have had a lot of work like that in the past, on old-type rotary machines, and we did not have any trouble handling it." Mr. McCamy asked about closed machines, and Mr. Youngblood said, "Whether you can do it on closed type machines, I wouldn't know."

Henry Dozier reported that at a previous connection in North Carolina, he had dyed 50,000 to 75,000 pounds of viscose and acetate staple satisfactorily on closed type machines, in both vat and developed colors, but not directs and sulfurs. Mr. Youngblood said, "There is a closed-type machine on the market that is divided into quarters, with separation plates between parts of the batch. They claim this gives good results. They have these perforated plates to keep the batch from packing."

E. D. Estes, of Stein, Hall & Co., reported that when he was at the Riverside & Dan River Cotton Mills they had operated 800 looms successfully for 3 years on constructions made of blends of cut rayon staple.

Mr. Whittelsey brought out that experience had shown it best not to overload a machine in dyeing rayon staple; that between 750 and 800 pounds appeared to be the best load in a 1,000-pound machine, of the closed type. "You will not have any trouble with packing if you will keep the load down. Also, it is best to wet out by gravity instead of by pressure; let the water flow into the batch and the machine get full before the pressure is put on." Henry Dozier added that it is also better to wet out cold instead of with heat.

Discussing the dyeing of rayon staple yarn in package form, W. B. Griffin brought out that it is best to wind it as loose as is practicable, and still avoid sloughing off, since rayon swells under the influence of caustic soda. J. E. Smenner said he had found it advisable to put a double bottom in a rawstock machine, and also to use no more than 700 pounds in a thousand-pound machine.

Curt Mueller asked for a discussion of the blends of some of the new fibers, and W. B. Griffin said that Aralac is now being blended with wool; "in fact, a very large percentage of the men's hats are now made with wool and Aralac, and it is also being blended with spun rayon and acetate and cotton for dress goods."

There was a brief discussion on new finishing and dyeing agents, particularly the synthetics. It was agreed that developments in such fields as synthetic resin finishes, pigment type dyeing, etc., will move along with developments in the newer fibers themselves. C. B. Walker pointed out that the public is going to demand better finishes in the way of permanent finishes, color-fastness, etc., and that the industry must give the public what it wants.

This discussion concluded the meeting. It was announced that the next meeting of the section will be held at the Atlanta Athletic Club, in Atlanta, on Saturday, December 4.

MEETING, RHODE ISLAND SECTION

THE first meeting of the season of the Rhode Island Section was held on September 24th, 1943, in the hall of the Providence Engineering Society with an attendance of 125.

Dr. C. M. Marberg of the Interchemical Corporation lectured on "The Electron Microscope in Pigment Research," by giving a general description of the instrument, the mathematical basis of its use, and many slides illustrating the vast difference between the sights and photographs available by the new method as compared with the ordinary microscopes. This was followed by a question period at which he was assisted by E. F. Fullam, who works with this electron miscroscope almost exclusively. A sound film, showing the more general activities of the Interchemical Corporation, completed the program and the meeting adjourned at 10:30 P. M.

Respectfully submitted,

ROBERT W. JOERGER, *Secretary.*

PIEDMONT SECTION PURCHASES WAR BONDS

THE Piedmont Section has purchased a total of $500.00 worth of Series F War Bonds since April, 1943.

The money for the purchase of these Bonds was accumulated in the treasury due to the suspension of the summer outings and paid entertainments at the four meetings each year for the past two years. It is assumed that this money will be used after the peace has been declared, or at the maturity of the Bonds, to defray the expenses for some worthwhile object closely related to the interests of the Piedmont Section.

The Piedmont Section has had record-breaking attendance at all meetings during the past year, even though unusual difficulties regarding transportation and hotel accommodations had to be faced.

MEMBERSHIP APPLICATIONS

Corporate

Kearny Manufacturing Co.

Senior

Felix P. Ambro—Colorist, Aridye Corp., Fairlawn, N. J. Sponsors: T. F. O'Brien, P. J. Kennedy.

Raymond Bourrioux—Chemist & Dyer, American Viscose Corp., New York, N. Y. Sponsors: T. F. O'Brien, P. J. Kennedy.

Theodore J. Bowes—Chemist, Onyx Oil & Chemical Co., Jersey City, N. J. Sponsors: L. P. Brick, C. D. Ehrengart.

Glenn K. Byers—Foreman Dyer, J. L. Stifel & Sons, Inc., Wheeling, West Virginia. Sponsors: W. F. Stifel, T. H. Walker.

Julius Albert Crumley—Supt., Hosiery Processing Co., Rossville, Ga. Sponsors: M. W. Moore, J. Anderson.

Marcel A. E. Delys—Dyer, Enterprise Dye Works, Inc., Woonsocket, R. I. Sponsors: C. E. Bergamini, R. J. B. Delys.

David James Dineen—Textile Colorist, Newburgh Bleachery, Newburgh, N. Y. Sponsors: W. F. Uhlig, T. M. Chadwick.

Harold R. Dinges, Jr.—Chemist, Sales Development Dept., Mathieson Alkali Works, Inc., Charlotte, N. C. Sponsors: J. W. Ivey, L. G. Atkins.

Thomas Joseph Dwyer—Head Dyer, Burlington Mills Corp., Plant G, Greensboro, N. C. Sponsors: C. B. Ordway, R. A. Gilliam.

Richard Eckert—Color Blender, Botany Worsted Mills, Passaic, N. J. Sponsors: T. F. Malloy, P. M. Otto.

Frank H. Emery—Chemist & Colorist, Sandoz Chemical Works, Ltd., Toronto, Canada. Sponsors: A. C. Goodings, J. C. Walker.

Josef Hugh Fasal—Textile Chemist, West Warren Print Works, Inc., West Warren, Mass. Sponsors: W. Gutig, J. E. Meili.

Maurice Rayner Fox—Research Chemist, L. B. Holliday & Co., Ltd., Deighton, Huddersfield, England. Sponsors: A. J. Hall, A. D. J. Piesse.

Timothy Gibson—Sales Manager, United Piece Dye Works, Lodi, N. J. Sponsors: S. M. Conn, P. J. Kennedy.

Samuel Glasberg—Chief Chemist, Colonial Print Works, Paterson, N. J. Sponsors: B. S. Hillman, P. J. Kennedy.

Bernard C. Grant—Products Engineer, Textileather Corp. & Toledo Dye Works, Toledo, Ohio. Sponsors: J. R. Redmond, E. C. Bertolet.

Chester Greene—Chemist, Mount Hope Finishing Co., North Dighton, Mass. Sponsors: T. A. McCann, P. H. Carr.

Aubrey Lewis Hanford, Jr.—President, Textile Printing & Finishing Co., Lebanon, Pa. Sponsors: H. N. Craig, M. M. Klotz.

Siegfried B. Horowitz—Chemist, Pilgrim Piece Dye works, Inc., Brooklyn, N. Y. Sponsors: E. Young, R. Hart.

Frank P. Jankowski—President & Manager, Novel Fabric Printers, Milwaukee, Wis. Sponsors: A. G. Alexander, H. W. Tetzlaff.

Roy Herman Kienle—Asst. Research Director, Calco Chemical Div., American Cyanamid Co., Bound Brook, N. J. Sponsors: G. L. Royer, C. L. Zimmerman.

Edward M. Ladino—Textile Technician, Better Fabrics Testing Bureau, New York, N. Y. Sponsors: C. W. Dorn, F. Stutz.

John Lang—Overseer of Dyeing, American Dyeing Corp., Rockville, Conn. Sponsors: A. Corry, R. W. Joerger.

Edwin R. Laughlin—Dyestuff Chemist, Technical Lab., E. I. duPont de Nemours & Co., Inc., Wilmington, Del. Sponsors: G. H. Schuler, C. A. Seibert.

John R. Magee, Jr.—Laboratory Director, Aralac Inc., Taftville, Conn. Sponsors: W. A. Stringfellow, D. G. Carmichael.

Anthony O. Martone—Supt., New Process Dyeing & Finishing Co., Paterson, N. J. Sponsors: T. F. O'Brien, P. J. Kennedy.

James V. Moore—Textile Colorist, E. I. duPont de Nemours & Co., Inc., Technical Lab., Wilmington, Del. Sponsors: C. A. Seibert, W. J. Zinck.

Edward C. Murphy—Boss Dyer, Baxter, Kelly & Faust, Inc., Philadelphia, Pa. Sponsors: R. A. Watson, L. P. Brick.

Fred W. Noechel—Chief of Physical Laboratories, Botany Worsted Mills, Passaic, N. J. Sponsors: T. F. Malloy, P. M. Otto.

Paul Otto, Jr.—Colorist, Botany Worsted Mills, Passaic, N. J. Sponsors: T. F. Malloy, P. M. Otto.

Earle F. Ramsbotton—Designer, Botany Worsted Mills, Passaic, N. J. Sponsors: T. F. Malloy, P. M. Otto.

Bernard C. Rioux—Textile Technician, Better Fabrics Testing Bureau, New York, N. Y. Sponsors: L. E. Rossiter, H. F. Leupold.

Harry Blair Smith—Head Dyer, California Hand Prints, Inc., Hermosa Beach, Calif. Sponsors: A. E. Slater, D. C. Metcalf.

Walter Stump—Asst. in charge of testing, American Viscose Corp., New York, N. Y. Sponsors: A. R. Wachter, A. J. Heinzmann.

Thomas F. Sullivan—Chemist, Empire Cotton Mills, Welland, Ont., Canada. Sponsors: T. F. Murphy, C. E. O'Connell.

William S. Woodson, Jr.—Chemical Engineer, Manhattan Shirt Co., Paterson, N. J. Sponsors: E. J. Driscoll, N. A. Johnson.

Junior

Gabriel F. Goldstein—Chief Chemist, Southbridge Finishing Co., Southbridge, Mass. Sponsors: H. W. Wil-

kinson, Jr., C. G. Hard.

Perry B. Hendricks, Jr.—Laboratory Asst., General Dyestuff Corp., New York, N. Y. Sponsors: C. Z. Draves, J. R. Bonnar.

Harold A. Jasmine—Textile Chemist, Botany Worsted Mills, Passaic, N. J. Sponsors: T. F. Malloy, P. M. Otto.

Irving B. Krieger—Salesman & Laboratory Technician, Krieger Color & Chemical Co., Los Angeles, Calif. Sponsor: B. Kapp.

Waldemar R. Kuenzel—Manager of Fabric Development Div., Viscose, E. I. duPont de Nemours & Co., Inc., New York, N. Y. Sponsor: P. J. Kennedy.

Lawrence M. O'Connell—Foreman, Pad Dye Dept., Sidney Blumenthal & Co., Shelton, Conn. Sponsors: H. H. Taylor, S. V. Vaniotis.

Winifred N. Pardey—Textile Technician, General Dyestuff Corp., New York, N. Y. Sponsors: J. R. Bonnar, B. A. Ryberg.

William Benjamin Thomas—Research Chemist, Maine Mills Laboratory, Lewiston, Maine. Sponsors: D. R. Kneeland, J. F. Munroe.

Jessie Ray Whisenant—Asst. to Dyer, Benjamin Kahn Ribbon Mills, Attalla, Ala. Sponsors: J. L. Grizzell, L. J. McGinty.

Stephen H. Wilson—Asst. Textile Dyer, Botany Worsted Mills, Passaic, N. J. Sponsors: T. F. Malloy, P. M. Otto.

Associate

Mrs. J. H. Crosland—Librarian, Georgia School of Technology, Atlanta, Ga.

Fred Kairys—District Sales Manager, Comfy Mfg. Co., New York, N. Y.

Mrs. T. R. Kuzdal—Inspector, Pratt & Whitney Aircraft Co., Williamantic, Conn.

Max Lane—Salesman, Warwick Chemical Co., Philadelphia, Pa. Sponsor: J. P. Conaway.

Harry C. Meltzer—Salesman, Haas Miller Corp., Hillside, N. J.

Dorothy C. Waters—Research Dept., Sidney Blumenthal Co., Shelton, Conn.

Student

James Thong Moy—Bradford Durfee Textile School. Sponsor: L. B. Coombs.

Donald T. Tweedy—Bradford Durfee Textile School. Sponsor: L. B. Coombs.

Applications for transfer to Senior membership, Frank P. Greenspan, Socrates V. Vaniotis.

PIEDMONT SECTION MEETING

THE Piedmont Section will hold its annual meeting on Friday evening, November 5, at Hotel Charlotte, N. C., instead of Saturday, as has been their usual custom. Crowded hotel conditions at the present time make it impossible for them to get accommodations for their usual Saturday meeting.

The annual election of officers and entertainment will follow the banquet.

The nominating Committee of the Piedmont Section, composed of D. Stewart Quern, Chairman; Samuel L. Hayes, Robert A. Bruce, Robert D. Sloan, Irving J. Royce, and Edgar Ford, has submitted to the membership the following slate of nominees for officers during the coming year:

Chairman—Henry B. Dixon.

Vice-Chairman—Sydney M. Cone.

Secretary—L. G. Atkins.

Treasurer—Wyss L. Barker.

Councilors—C. Norris Rabold, Dr. R. E. Rupp.

Sectional Committee—H. H. Field, R. B. Macintyre, Thorwald Larson, W. A. Wolhar.

According to the by-laws of the Piedmont Section, nominations must be submitted to the membership at least thirty days prior to the final meeting of the year. Counter nominations, signed by at least three members in good standing, must be filed with the Secretary within 20 days after notice has been given of nominations of the Nominating Committee in order to appear on the final ballot.

Reservations for the banquet should be sent to Leland G. Atkins, Southern Dyestuff Corporation, Charlotte, N. C. Hotel reservations should be made directly with the hotel as early as possible to assure accommodations.

MEETING DATES, RHODE ISLAND SECTION

THE Rhode Island Section has scheduled meetings on the following dates for the balance of the season: October 29, 1943; November 26, 1943; January 28, 1944; February 25, 1944; March 31, 1944.

• CALENDAR • OF COMING EVENTS

Meeting, Mid-West Section, Bismarck Hotel, Chicago, Illinois, October 16, 1943.

Intersectional Contest, in conjunction with New York Section Meeting, Downtown Athletic Club, 19 West St., New York City, October 22, 1943.

Council Meeting, Downtown Athletic Club, 19 West St., New York City, October 22, 1943.

Research Committee Meeting, Chemists' Club, 52 East 41st St., New York City, October 23, 1943.

Meeting, Philadelphia Section, Hotel Philadelphian, Philadelphia, Pa., October 29, 1943.

Meeting, Rhode Island Section, October 29, 1943.

Meeting, Piedmont Section, Hotel Charlotte, Charlotte, N. C., November 5, 1943.

Meeting, Southeastern Section, Atlanta Athletic Club, Atlanta, Ga., December 4, 1943.

MEMBERSHIP COMMITTEE, NEW YORK SECTION

PATRICK J. KENNEDY, chairman of the New York section, has announced the appointment of the membership committee under the chairmanship of Thomas F. O'Brien, vice president and general manager of the R. W. Bates Piece Dye Works at Garnerville, New York. Mr. O'Brien is a director of the Silk and Rayon Dyers and Printers Association of America, Inc. He was formerly connected with Mallinson's and taught fabric construction at one of the New York City textile schools for several years. He is well known in the New York dyeing and converting market. The other members of Mr. O'Brien's committee are:

Lt. Edmund F. Monroe, Vice Chairman, Quartermaster Corps, U. S. Army.

Miss Bernice S. Bronner, Vice Chairman, Good Housekeeping Institute.

Kenneth Barnard, Pacific Mills.

Herman P. Baumann, Allied Textile Printers, Inc.

Winn W. Chase, *Textile World*.

Charles W. Dorn, J. C. Penney Co., Inc.

Thomas F. O'Brien

Dr. Victor Froelicher, Geigy Co., Inc.

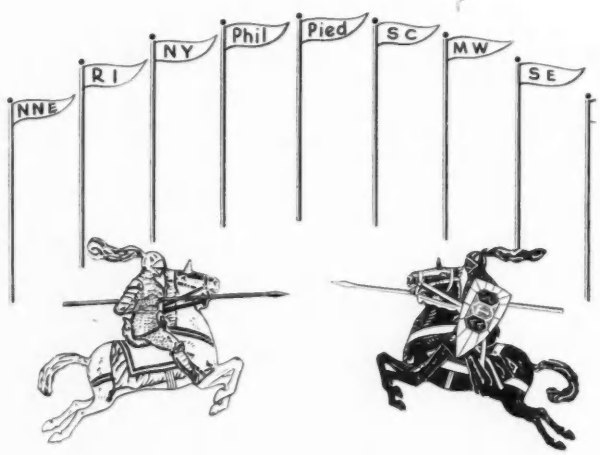
George C. Lommel, Calco Chemical Division, American Cyanamid Co.

Thomas F. Malloy, Botany Worsted Mills.

Dr. Oliver M. Morgan, National Aniline Division, Allied Chemical & Dye Corp.

Ralph B. Smith, New Jersey Laundryowners Assn.

Dr. Harold H. Taylor, Sidney Blumenthal & Co., Inc.



FOURTH ANNUAL

Intersectional Contest

(In conjunction with New York Section meeting)

Downtown Athletic Club, 19 West St., New York, N. Y.

OCTOBER 22, 1943

TRADE NOTES • NEW PRODUCTS

• APPOINTED RESEARCH MANAGER

Giles E. Hopkins, well known research man in the textile industry, has been appointed reasearch manager of the Textile Research Institute, Inc. A graduate of Massachusetts Institute of Technology, Mr. Hopkins was for many years technical director of the Bigelow-Sanford Carpet Company. He was one of the organizers of the Industrial Research Institute, a group of directors of research brought together to study the administration problems peculiar to research and technical personnel. He succeeds Malcolm E. Campbell, who has been appointed dean of the textile school at North Carolina State College, but who will continue to be active in the affairs of the Institute as a member of its Technical Research Committee.

In announcing the new appointment, Fessenden S. Blanchard, president of the Textile Research Institute, Inc., stated: "We in the Institute feel particularly fortunate in securing the services of Mr. Hopkins because he has always had an industry-wide point of view, and a recognition of research as a tool not to promote any one fiber or any one type of equipment, but rather as a channel to progress for the textile industry as a whole. And that is what the program of the Textile Research Institute, Inc., has as its objective."

In addition to his connection with Bigelow-Sanford, Mr. Hopkins has been chemist with Factory Mutual Fire Insurance Laboratories; chemical engineer with the Research Division of the United Shoe Machinery Corp.; technical director of the U. S. Asbestos Division of Raybestos-Manhattan Inc.; and, more recently, chief of the Industrial Production Section of the Reoccupation Division of the office of Economic Warfare. In his new association, he will continue to be active in the war effort, as the Textile Research Institute, Inc., is engaged in research contracts for the Government.

His technical society activities included organization of the wool committee of the American Society for Testing Materials; membership of the executive committee of that institute; and chairmanship of a special committee of the Textile Research Committee directing a research project on the drying of textile fibers.

Mr. Hopkins will have the advisory help of the Technical Research Committee of the Institute, whose members include: W. D. Appel, chairman, A. G. Ashcroft, F. Bonnet, Winn Chase, Alban Eavenson, Milton Harris, Charles J. Huber, W. O. Jelleme, Rinaldo A. Lukens, Thomas Nelson, E. R. Schwarz, R. W. Vose, A. C. Walker.

• TAPIOCA DEXTRINE UNDER CONTROL

The use of tapioca dextrine and other modifications of tapioca flour has been brought under control of the War Production Board. Conservation Order M-333 as revised extends the scope of the order by adding to materials under control tapioca dextrine and any modification of tapioca flour made through mixture with other chemicals, starches or flours, or through modification of the starch itself by hydrolization or chemical reaction.

The order has prohibited use of tapioca in the textile industry as a warp size, except for synthetic fiber. Revision of the order makes similar exceptions in the case of warp sizes for combed cotton yarns 40 and finer, and for cordage fibers. The order has been extended also to prohibit the use of tapioca as a finishing or loading medium to all textiles, except when Army or Navy specifications call for its use as such.

To restrict still further the use of tapioca for less important purposes, the order has been amended so that no dealer may sell an amount equal to more than 5 per cent of his total sales in the previous month to persons whose orders come within the small order exemption of 600 pounds or less in one month.

The revision permits companies with more than three months supply of tapioca to consume stocks in excess of inventory limits, because it is impractical to transfer the material to other firms.

Quarterly reports on inventory receipts and sales are required from processors and distributors of tapioca and tapioca products under the amended order.

• AWARDED "E"

The Front Royal, Va., plant of the American Viscose Corporation has been awarded the Army-Navy "E" for excellence in war production, it was announced today. Presentation ceremonies will be held on October 14. The plant is one of the largest rayon producing plants in the United States, much of its output consisting of extra-strength rayon for use in tire cords for fighting planes and military vehicles.

• WEST COAST RECLOTHING SERVICE

Effective September 15, it was announced recently by Proctor & Schwartz, Inc., Philadelphia textile and drying machinery manufacturers, arrangements were completed with National Automotive Fibres, Inc., Railroad Avenue & Kennedy Street, Oakland, California, whereby they will serve as Proctor's West Coast reclothing shop.

Doing all reclothing work on garnett cylinders for West Coast plants, National Automotive Fibres, Inc., will use Proctor Wire exclusively and all work will be done at the standard Proctor prices which prevail at the Proctor reclothing shop in Chicago, Ill.

• ELECTED VICE PRESIDENT

The Board of Directors of The Procter & Gamble Company announce the election of Thomas J. Wood as Vice President in Charge of Sales, and a Director of the Company. He fills the vacancy caused by the death of Clarence J. Huff.

Mr. Wood joined the Company in 1919 as a salesman in the St. Louis district. He served in sales supervisory capacities in the Company's western division and became Manager of the Kansas City District Office in 1923. Five years later he was promoted to Western Division Manager, and in 1938 was named General Sales Manager.

• APPOINTED SALES DIRECTOR

Hercules Powder Company announced recently the appointment of G. Fred Hogg as sales director of its Naval Stores Department.

Mr. Hogg, who was formely manager of the Naval Stores Department office in Chicago, has spent the past year at the chemical company's industrial explosives plant in Hercules, Calif., where he served as technical assistant superintendent and chairman of the plant's War Manpower Committee.

The new sales director for Hercules pine chemical products joined the company in 1929 as a chemist at the Kenvil, N. J., laboratory, after having received his M.S. in chemical engineering from the University of Michigan.

In 1930, he joined the Naval Stores Department as a sales and service representative. In 1935, he was transferred to the Chicago Naval Stores office, and was appointed manager in February, 1936.

• COLUMBIA TEXTILE COURSES

The Evening Textile Courses at Columbia University opened their Fall 1943 Semester on September 30th. The courses are under the supervision of H. R. Mauersberger and have been given for the last 26 years.

Practical intensive lecture courses are offered in Cotton Yarn & Fabric Manufacture; Rayon & Spun Rayon Yarn & Fabric Manufacture; Wool & Worsted

Manufacture; Identification, Analysis and Testing of Textiles; Textile Chemistry & Dyeing; and Textile Design. The courses are supplemented by trips to plants, moving sound and color films, textbooks and personal attention by teachers of long experience and excellent reputation. The courses extend over 15 weeks, one a week.

For further information phone MUrray Hill 4-1159.

● INCREASED PRODUCTION VITAL

Increased production of all yarns and fabrics is vital to the war program, Frank L. Walton, Director of the Textile, Clothing and Leather Division, War Production Board, said recently.

"Whether it is cotton, wool or rayon yarns and fabrics, we need all we can produce and we must find ways to make more," Mr. Walton said. "While we lost some production during the second quarter compared to the same quarter last year, we hope the lag is only temporary and simply reflects production losses resulting from absenteeism during the summer months and, in some plants, from vacation shut-downs of a week. With the summer season behind us, it is urgent that production schedules be stepped up and that lost time be made up in every way possible."

Mr. Walton revealed that last June he received letters from a number of plants assuring him that they could make up lost time due to vacations. "We are expecting those plants to make up all such time lost," he said. "We believe we can count on both labor and management to do this—it is vital to the entire war textile production program. We want to urge mills to maintain all shifts now in operation and to add more shifts wherever possible."

While labor shortages have caused manpower problems in some textile plants, Mr. Walton suggested that recruitment and training programs should in part at least solve these problems. He added that the Textile Division has noted increasing employment of women in many plants and said that with the good work being done by women textile operators should come also a realization of how essential to the whole war program are the yarns and fabrics they are making.

"These plants have been declared essential to the war program, and operators should be proud to work in them," Mr. Walton said.

Reviewing the present outlook for the textile industry, Mr. Walton said:

"We have many essential demands for our production and the world-wide demands are increasing. We will have to take care of more of these needs.

"In my opinion these requirements will continue long after the war is over; there is now and will be after the war a shortage of essential fabrics and yarns. Accordingly, mills should keep up their production schedules without let-up. With a world-wide demand, mills can plan on capacity operations after the end of the war.

"The Textile, Clothing and Leather Division is making plans accordingly and in the light of studies of the post-war situation. We are developing plans which we hope will permit the continuous operation of textile plants without interruption. We are sure it can be done and we hope to have these plans ready in the near future, worked out plant by plant. Maximum operation of textile mills is essential for the post-war period, particularly in meeting the objective of full employment and in maintaining the over-all economy of the country.

"If any mills are out of balance, now is a good time to try and get in balance. We will gladly try and help if the mill will write us details of what they can do to get more production.

"We are also working on a number of the other problems facing textile mills at this time and we believe with some success, so we will be glad to hear from any mill with any suggestion that will help their production or production in general in the textile industry."

● SECOND "E" AWARD FOR P. & G. DEFENSE CORP.

The Wolf Creek Ordnance plant at Milan, Tenn., operated by the Procter & Gamble Defense Corporation, subsidiary of Procter & Gamble, has won the Army-Navy Production Award for the second time.

A white star has been added to the Army-Navy Production Award Flag which was presented to the Wolf Creek plant on December 3, 1942.

In announcing the award, Robert P. Patterson, Under Secretary of War, stated in a letter," "You have continued to maintain the high standard that you set for yourselves and which won you distinction more than six months ago. You may well be proud of your achievement."

Another Procter & Gamble subsidiary, The Chemical Pulp Division of The Buckeye Cotton Oil Co., was awarded the Army-Navy "E" at its Memphis, Tenn., plant earlier in the month. This plant produces cotton linters for use in smokeless powder.

● APPOINTED PLANT MANAGER

Louis L. Shapiro has been appointed plant manager of the Glyco Products Co., Inc., Brooklyn, New York.

Mr. Shapiro was graduated from Franklin and Marshall College with the degree of B.S. in Chemistry and later received his degree in Chemical Engineering from the Drexel Polytechnic Institute.

Mr. Shapiro, for the past fourteen years, has served as chief chemist, director of the Chemical and Research Departments and assistant superintendent with the Wilson-Martin Division of Wilson and Co., Inc.

● TWO NEW FATTY ACID DERIVATIVES

Emery Industries, Inc. of Cincinnati, Ohio announced recently the availability of two new and unusual derivatives of animal fatty acids.

The first of these, Azelaic Acid, is described as a dibasic aliphatic acid, having a nine-carbon chain with carboxyl groups at each end. Its melting point is given as 96 deg. C. Several examples of its reactions are given, laying emphasis upon its ability to form soft alkyd resins with glycerine and other suitable polyhydric alcohols. It is said that in general, the esters of Azelaic Acid have higher boiling points than those of fatty acids of corresponding molecular weights. This characteristic is pointed to as suggesting their use as platicizers.

The second development is described as a series of low molecular weight, monobasic acids, in which the unusual nine carbon acid, Pelargonic, predominates. The properties of this acid are described along with many of its characteristic reactions. Again the esters are described in detail because of their application to the oil modification of alkyd resins with which, it is said, they are quite compatible.

● "DYE MARKER"

A chemical that lights up the water of the ocean, making a huge yellow patch visible several miles away in a plane 10,000 feet in the air, is one of science's contributions looking toward the safety of American airmen. The solution will enable searching planes to discover and rescue airmen who have been shot down in action whether they are afloat in life rafts or floating alone in life jackets.

The contents of a package three inches by five will light up a patch of sea 40 feet in diameter and instead of being just a surface slick easily dissipated by the waves, the patch is tri-dimensional,—having width, length and depth.

According to the naval bureau of aeronautics, research and development engineers for pilot safety, the naval attache in London reported to the Navy Department in Washington that German pilots were equipped with rescue markers.

Chemists of the the Calco Chemical Division of the American Cyanamid Company within a short time found the answer in fluorescein, a material that at one time was used to discover leaks in water

This shows how the Life Jacket "Dye Marker" is attached to the life jacket.

systems. The minute it touches the water it not only spreads with great rapidity, but sinks to a depth of several feet, thus creating a block wave action does not disintegrate over a period of from two to three hours.

The package of "Dye Marker" as it is officially known, is cemented to the aviator's life packet and has a rip flap, somewhat similar to the rip-cord of a parachute. When a flyer lands in the water, he waits until a rescue plane is within range before breaking the seal. He must be certain, however, that it is a friendly plane before he marks his position. Life rafts also carry cans of "Dye Marker."

According to Navy men, if Captain Rickenbacker and his crew had been supplied with these markers when they floated around the South Pacific Ocean they doubtless would have been seen by the searching plane that passed near them a few days after they took to the life rafts. Fliers say nothing is more difficult to see from the air than a man floating in the water. Even a raft full of men is like looking for a needle in a haystack.

The proportion of dye to water for high visibility is one part to sixteen million parts.

Special machinery seals the material in a waterproof package as brilliantly yellow as the dye itself.

Another use for the dye was found as a "Driftmarker." Over the ocean the navigator has nothing to determine the drift of a plane caused by wind. On land, trees, hills and other objects are available. A special bomb was designed that when dropped from a short distance breaks on impact with the water and the resultant spot gives something tangible on which to focus instruments.

This picture, taken from a height of only 100 feet, shows the difficulty of spotting a man in the water from a rescue plane.

This picture was taken 3 minutes after pulling rip flaps, showing wide dispersal of dye around the aviator.

● HERCULES' "E" AWARDS

More than 1,800 men and women of Hercules Powder Company's home office and Experiment Station are now entitled to wear the Army-Navy "E" pin for their share in the war effort, it was announced recently.

Under the rules of the War Department governing "E" awards, employees of the central office of a corporation are given "E" pins after a majority of the employees of that corporation has received the award.

Hercules has raised Army-Navy "E" flags at its Radford Ordnance Works, and at its Kenvil, N. J.; Parlin, N. J.; Hopewell, Va.; Port Ewen, N. Y.; Belvidere, N. J., and Hercules, Calif. plants. Two-thirds of its 31,000 employees, including those in government-owned ordnance works, now wear "E" pins.

Commenting on the award, Charles A. Higgins, Hercules president, said: "The extension of the Army-Navy 'E' to the men and women of our home office and Experiment Station constitutes recognition of the important part played here in the production of explosives and chemical materials for the war effort. The splendid achievements of our plants are due in part to the office and laboratory work done in Wilmington.

"I am very happy that under the War Department's arrangements for 'E' awards, we are now entitled to wear the 'E' pin."

● NATIONAL STARCH TO MOVE

National Starch Products Inc.'s executive office and research laboratories, which for the past 18 years have been located in the company's own 6-story building at 820 Greenwich Street, New York, will move "uptown" to new and more spacious quarters about November 15, according to an announcement made by officials of the company.

The new headquarters, comprising 24,000 square feet of floor space, will occupy the entire ninth and tenth floors of a modern steel and concrete 23-story building at 270 Madison Avenue, Corner of 39th Street.

Increasing demands of war industries, together with a steady expansion in the scope of National's activities during the past decade and a desire to provide for post-war plans, are the chief factors governing the company's need for more space. An estimated 90 per cent of the current production of its four domestic plants is for lend-lease, military, and essential civilian requirements.

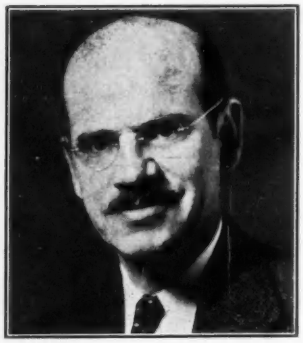
Originally, National occupied but one floor of the Greenwich Street building, but as the organization grew to its present position in the industry, its offices and laboratories gradually spread over the entire six floors. An active research program placed a further strain on its facilities, and emphasized the advantages of a move to larger and more centrally located quarters.

Shipments to eastern customers will continue to be made from National's Plant No. 1 at Dunellen, N. J. Others of the company's domestic plants are located at Chicago, Indianapolis, and San Francisco.

● JOINS TEXTILE RESEARCH INSTITUTE

Douglas G. Woolf, editor-in-chief of *Textile World*, has resigned after 27 years association with that publication to become vice-president and director of information of the Textile Research Institute, Inc., New York. In taking this step, Mr. Woolf is putting into action his personal advocacy, over a quarter of a century, of research as the most vital need of the textile industry.

In his new connection, which will start on October 15, he will direct all the information services of the Institute, which include the magazine, *Textile Research*, of which Julian Jacobs continues as editor, and the abstracts and supplementary publications. He will also direct the projects which will be formulated by the Economic Research Committee of the Institute, under the chairmanship of Robert R. West, president of Esmond Mills, who recently accepted that responsibility. Mr. Woolf will



Douglas G. Woolf

also have charge of research in employer-employee relations, and will assist the president of the Institute as liaison officer with various committees, research projects, and with members. His efforts will be directed particularly toward the post-war problems of the textile industry.

In announcing Mr. Woolf's appointment, Fessenden S. Blanchard, president of the Textile Research Institute, stated:

"We are extremely fortunate to have been able to secure the services for the Institute of a man of the outstanding qualifications of Mr. Woolf. Well known among all branches of the textile industry for his ability and courageous leadership as editor of *Textile World*, he will now be able to give his full time to the cause for which he has been a pioneer for so many years—textile research. In the important new work which he is undertaking, he will, I am sure, be able to perform a service of the greatest value to the industry."

After leaving Cornell University in 1911, Mr. Woolf spent several years as a textile chemist in cotton bleacheries. He went to Persia in 1914 and installed there his own process for dyeing wood for oriental rugs. In 1916, he joined *Textile World* as an assistant editor and has been with that publication since then, with time out for service in World War I as an aviator in this country and in France. He became managing editor in 1928 and editor-in-chief in 1930. During his editorship Mr. Woolf won two awards for outstanding editorials.

He has served as president of the National Conference of Business Paper Editors; as secretary of the New York Business Paper Editors Conference; as secretary of Committee D-13 of the American Society for Testing Materials; and as a member of the executive committee of the Textile Research Institute, Inc., and chairman of its Publications and Publicity Committee. He is the author of "The Business Paper Editor at Work," published jointly by the Associated Business Papers and the McGraw-Hill Book Co., and of countless articles on textile problems.

In commenting on his new connection, Mr. Woolf stated: "I have a deep conviction that the future of the textile industry depends upon a completely open-minded approach to its post-war problems, involving not only competition from other industries for its markets, but also intra-industry competition among fibers and types of machinery. That means research. Fortunately, there is a current growth of interest in research in all parts of the textile industry, as evidenced by the formation of several new organizations. There is no limit to the need for textile research; consequently there is no reason for competition among these new research enterprises. But there is need for coordination. It is my hope that the Textile Research Institute, Inc., representing as it does all branches of the industry and all sections of the country, may serve as a coordinating influence, by means of which all the organizations will work together toward a common objective: the elevation of the textile industry to a position of security for capital, management and labor.

"Certainly, all of us who remember the textile aftermath of World War I realize that nothing short of an all-out research offensive by the industry as a whole can prevent a far more destructive textile aftermath of World War II.

"The job I am starting on now is the crystallization of the observation and study of more than a quarter of a century. If I can now serve in a practical way to bring the textile industry nearer to an acceptance of research as the only real solution of its problems, I shall feel that my years of preaching this doctrine will not have been in vain."

Mr. Woolf is a member of the Textile Institute, of Manchester, England; the American Cotton Manufacturers Association, of Charlotte, N. C.; the National Association of Cotton Manufacturers, of Boston, Mass.; the Southern Textile Association, of Charlotte, N. C.; the American Society for Testing Materials; the National Conference of Business Paper Editors; the New York Business Paper Editors Conference; the National Press Club, of Washington, D. C., and other organizations.

● CELANESE PATENTS

Three patents relating to the fire-proofing of textile materials were granted recently to Celanese Corporation of America.

According to the United States Letters Patent No. 2,230,251 cellulose acetate or other organic derivative of cellulose textile material is impregnated with 5 to 10 per cent of a halogenated alkyl ester of phosphorus—such as tri-monochlorethyl phosphate—by immersing the same in a bath containing said ester, a dispersing agent, pine oil and water for several hours at elevated temperatures.

This invention is said to be particularly valuable for fire-proofing the pile portion of rugs.

United States Letters Patent No. 2,330,253 is directed to belting suitable for power transmission and conveyor belts. These belts are made of cotton and have incorporated therein cellulose acetate or other organic derivative of cellulose plasticized with 5 to 85 per cent of a halogenated alkyl phosphate.

United States Letters Patent No. 2,330,254 is directed to cellulose acetate or other organic derivative of cellulose textile material having an imporved hand and fire-resistant properties due to the incorporation therein of 5 to 50 per cent of trichlorethyl phosphate as the sole plasticizer and fire-retarding agent.

● LEWIS S. MUNSON RETIRES

Lewis S. Munson, who as production superintendent and later plant manager of the Du Pont Dye Works played an important part in building the great American dye industry, retired October 1 at the age of 70.

His first 23 years with the company were spent at the Dye Works, Deepwater, N. J. During the past two years he has been at the company's headquarters in Wilmington, assisting in the management of that enterprise.

He was one of a very small group of American chemists and engineers who had acquired some practical knowledge of synthetic dyestuffs manufacture before the United States' entry into the First World War cut us off from the German dye supply. He was called in to help create a new industry, and the Dye Works became one of the starting points for the production not only of fine domestic dyes, but of a rapidly increasing list of other useful organic chemicals. Mr. Munson's career, therefore, spans the growth of America's synthetic organic chemicals industry.

At a testimonial dinner given in the Hotel du Pont, Mr. Munson's colleagues recalled that his tact, good humor and calm temperament contributed in a large measure to the successful organization and operation of the Dye Works.

Mr. Munson was born on a farm near Three Rivers, Michigan, was educated in the district school and at Michigan Agricultural College, from which he received his Bachelor of Science degree in 1897.

He served as assistant chemist at the College Experiment Station for two years and then for seven years was connected with the Bureau of Chemistry in the U. S. Department of Agriculture, where he worked with the late Dr. Harvey Wiley

in establishing pure food regulations. For eleven years he was chief chemist with Ault and Wiborg, Cincinnati, Ohio, manufacturers of pigments and inks. He came to the Du Pont Company in April, 1918, and was made superintendent of production at the Dye Works in 1919. He became plant manager January 1, 1930.

"Among the many problems confronting us in the early days," Mr. Munson recalled, "was that of obtaining suitable equipment for the new processes. We wore it out almost as fast as we could buy it. Since that time stainless steel, silver, special alloys, aluminum, and glass have been adapted to plant equipment and as a result it is today eminently satisfactory. Capacities of the apparatus have also tremendously increased. A pressure autoclave of 75 to 80 gallons was in those days considered large. Today enormous autoclaves operating at thousands of pounds per square inch pressure are commonplace."

Synthetic indigo, from aniline, and sufur black, from dinitrophenol, were among the first dyes produced at Deepwater, Mr. Munson related, and then the plant branched out into the production of far more important dyes and intermediates.

"It was soon found these intermediates were useful in making other things than dyestuffs," he remarked. "Rubber accelerators could be manufactured from aniline and related products. Detergents and other chemicals for use in the textile industry were also developed."

The Dye Works grew at a rapid rate and soon included plants for the manufacture of alcohol, tetraethyl lead, neoprene and camphor. The neoprene plant was the first synthetic rubber factory in America. Mr. Munson contributed much to the successful carrying out of these numerous expansions.

• ANNUAL MEETING, T. R. I.

F. S. Blanchard, President of the Textile Research Institute, Inc., has announced that the Annual Meeting of the Textile Research Institute, Inc., will be held on Thursday, November 18, 1943, at Hotel Roosevelt, New York.

Dr. Hugh S. Taylor of Princeton University will be the guest speaker at the luncheon. Besides the usual morning meetings of members and directors, important research meetings—the subjects of which will be announced later—will be held in both morning and afternoon.

• ACCIDENT TOLLS

Accidents—97 per cent of them preventable—cost the nation 5,200,000,000 and 380,000,000 man-days of work in 1942, the National Safety Council reveals in the 1943 edition of its annual statistical yearbook, "Accident Facts."

On-the-job accidents killed 18,000 workers—500 more than in 1941—injured 1,750,000 (150,000 more than in 1941) and resulted in a loss of time sufficient to have built 18,000 heavy bombers or 55 battleships.

All-accident death totals in 1942 (including occupational) were 93,000 killed and 9,200,000 injured.

• AQUA-SEC FOUNDER RESIGNS

Donald M. Martin, founder of the Aqua-Sec Corporation and its president since 1929, has announced his resignation. Mr.

Donald M. Martin

Martin has already formulated his plans for the future, and these will be announced shortly. He will remain closely associated with the field in which he is widely known.

Mr. Martin founded the Aqua-Sec Corporation in Chicago in 1929 on the basis of an idea which was unique then, but which has since become standard industry practice. He originated the Aqua-Sec Repellent Finish for fabrics and promoted this to the consumer by name as an extra quality feature.

This idea proved so successful that Mr. Martin expanded his organization and moved to New York City in 1931. Here he continued to experiment in the field of textile finishing and developed several now processes. Among these are permanent finishes of both the resin and cellulose type, mildew resistant finishes, and fire retardant finishes.

During the past several years Mr. Martin has devoted his energies to perfecting finishes for the many fabrics used by the military services.

The Aqua-Sec Corporation will continue in business under the direction of Mr. W. H. Scott.

• DR. BOHNSON RETIRES

Dr. Van L. Bohnson, one of the leading figures in the development of acetate rayon production in this country, retired recently as Director of Acetate Research, the Du Pont Company announced. It is because of health considerations that Dr. Bohnson has decided to withdraw from active service.

He is being succeeded by Dr. Fenton H. Swezey, who has been assistant director of Acetate Research since January 1, 1942. Dr. G. S. Hooper becomes assistant director.

Entering what was then known as the Du Pont Rayon Company in July, 1927, Dr. Bohnson was almost immediately assigned to do research on acetate rayon, a new product which had been developed in Europe. He made numerous trips abroad to study the processes there and was given the responsibility of transferring manufacturing information from the French Rhodiaceta Company to the United States when the Du Pont Company purchased production rights from that concern.

Subsequently Dr. Bohnson guided research on acetate products and was located at the Du Pont acetate plant at Waynesboro, Va., for many years.

Dr. Bohnson is a native of Clinton, Iowa, and a graduate of the University of Wisconsin, where he also obtained his graduate degrees and where he taught chemistry a number of years before and after the First World War. Entering the service in 1917 he became a major in the Chemical Warfare Service at the age of 27 and was acting director of a staff corps in charge of training troops in defense against war gases. He came to the Du Pont Company after several years as research chemist with the Oldbury Electro-Chemical Co., Niagara Falls.

• ANNUAL REVIEW NUMBER

The Eighth Annual Processing Review Number of the AMERICAN DYESTUFF REPORTER will appear on November 22nd, 1943. This issue will contain all of the papers which will be presented at the Fourth Annual Intersectional Contest on October 22nd in New York.

Another special feature of this issue will be a listing of new products for the textile wet processing industry which have been brought out since November, 1942. Manufacturers are invited to submit information concerning their new products. This information should include the trade name of the product and a BRIEF summary of its uses. Each product should be listed on a separate sheet of paper. In order to insure publication in our issue of November 22nd, this information should be in our hands no later than October 29th.

CLEANING TEXTILE MILL BELTING

W. F. Schaphorst, M.E.

IN the textile mill oil is one of the principal enemies of the belt. There are oils on the market that stay put—that do not drip—and there are enclosed bearings which do not permit dripping—but the average mill has not yet arrived at the use of dripless oils and bearings. Therefore the problem is: What is the best way in which to remove oil from oil soaked belting?

Although oil does not damage some belts seriously an excessive amount of oil *does* cause slipping. As soon as slip occurs there is an unnecessary power loss which is directly proportional to the slip. For instance, if the slip amounts to 2 per cent the power loss is 2 per cent and the production loss is also 2 per cent. If the slip is 5 per cent the power and production losses are 5 per cent. In other words, percentage of power and production loss is identical with the percentage of slip.

Continued use of a leather belt soaked in mineral oil will develop cracks from fiber abrasion inside. The natural animal oil in high grade leather protects these fibers against sawing one on the other. Harsh mineral oil removes this film of natural animal lubricant, and allows the fibers to contact and develop abrasion. Degreasing will remove the mineral oil and redressing with animal oil will replace the film on each fiber, which means pliability without internal damage.

Excessive slip may also cause burning of the belt. Burning is often more serious than the power loss, cracking, and abrasion combined. It can be surprisingly expensive.

There are two general ways in which to tackle this oil soaked belting problem mentioned above, namely:

First: Improve your oil conditions if possible so that there will be no leakage or splattering of oil onto the belt. By so doing, it will not be necessary to give the belt a periodic cleaning.

Second: Use a good belt that is as immune as possible to being harmed by oil and then clean that belt periodically—provided it does become oil soaked despite all you can do.

Numerous cleaning agents are recommended for washing leather belts such as a mixture of petrol and turpentine; gasoline; naphtha; kerosene; benzon; carbon tetrachloride; aqua ammonia; alcohol; soda and water.

In general these rules may be followed: Immerse the loosely wound coil, on edge, in the liquid, and allow to soak over night. Then stand on the other edge for 10 hours. If the belt is dirty in addition to being oil soaked, the dirt usually loosens and settles to the bottom. The dirt that does not loosen and settles can generally be removed with ease by brushing or scraping. To hasten drying the belt may be run through an ordinary washing wringer, provided the belt is not too wide. If too wide for a wringer, dry with a cloth.

A putty knife or similar broad scraping device having rounded corners is a good tool for scraping leather belts. Fibers of a belt, whether leather or substitute, must never be injured.

Place dry sawdust on the belt after laying the belt flat on the floor and clean with a stiff broom. Then turn the belt and do the same to the other side. After this it is a good plan to pack the belt in powdered chalk, Fuller's earth, or fine sawdust and keep it in a warm place. The warmth improves capillary attraction and will aid the material in absorbing the oil. After the belt is dry lubricate it with a suitable dressing recommended by the manufacturer of the belt.

When using gasoline or naphtha be extremely careful. According to the U. S. Bureau of Mines if gasoline is stored in an open place, as in a pail, the room in which the pail is left will soon be filled with an easily explosive mixture. The limits of explosibility are between 1.5 per cent and 6 per cent of gasoline vapor in air. In other words, only a little gasoline vapor is needed to render air explosive—one and one-half cubic feet of gasoline vapor for each 97½ feet of air. One gallon of gasoline can, when perfectly mixed, render 2100 cu. ft. of air explosive.

Some types of pulleys also collect oil and become "oil soaked." An oil soaked belt on oil soaked pulleys is a very poor combination for power transmission. Pulleys can be degreased as well as belts by a process very similar to that described above.

Sometimes hot irons are applied to belting to drive out the oil, blow torches are resorted to, or where available, steam is used. Steam is preferable to hot irons of course, but even with steam the utmost caution must always be exercised in its use. Steam is an excellent cleanser for many purposes, but it must be remembered that many kinds of belting cannot withstand the high temperatures that go with steam. The temperature of steam at atmospheric pressure is 212 deg. F. The higher the steam pressure the higher the corresponding temperature.

212 deg. F. is too hot for most rubber belting. One prominent rubber belt manufacturer states that his belting is not affected by heat up to a temperature of 200 deg. F. He states that where higher temperatures are to be encountered he should first be consulted. That is good advice regardless of the kind of belt. Even where steel chains are used one must be careful in high temperatures or lubrication difficulties will be experienced. Of course steel chains can be cleaned safely with steam.

Balata belting is more sensitive to high temperatures than rubber. Its temperature should be kept down to less than 110 deg. F. At 125 deg. balata gum can be moulded, therefore NEVER heat balata belting in *any* way.

According to one authority oak tanned leather belting should not be subjected to a temperature higher than 115 deg. F., which means, of course, that oak belting, also, must not be cleaned with steam. It can't stand it.

Nor should impregnated cotton belting be cleaned with steam because the steam will very likely wash out the impregnating compound. Without the compound cotton belting does not give satisfactory results. Stitched canvas belting should not be used in temperatures higher than 140 deg. F.

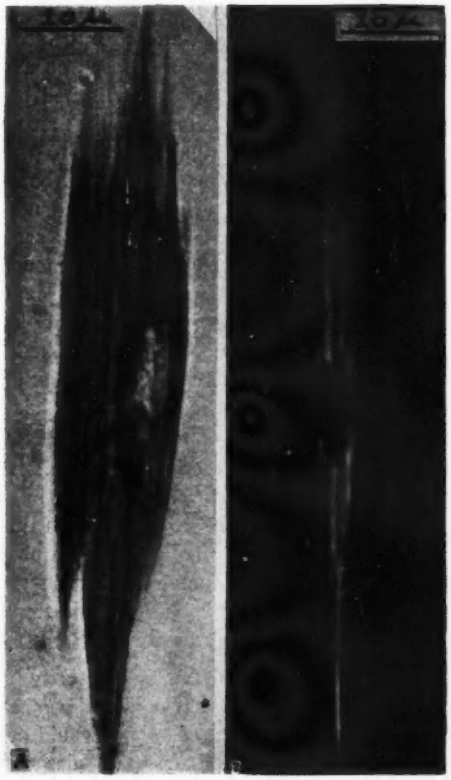
STRUCTURE OF THE WOOL FIBER

(Continued from page 436)

was found that over a wide range of magnifications the fibrous nature of these cells was still evident (figures 7 and 8). However, whereas only fibrils were observed with the optical microscope, the electron microscope resolved still finer filaments which, in the present investigation, will be called microfibrils. Zahn (30, 31) has similarly distinguished between fibrils and microfibrils in cortical cells. Figure 7,b shows the end of a cortical cell which has become frayed during preparation for examination. The separation of the fibrils (about 1 micron in width) from each other and their subdivision into microfibrils is also evident. Figure 8 represents part of another cortical cell at a higher magnification and in greater detail. The micrograph shows, essentially, parts of two fibrils, each made up of microfibrils and each connected to the other by additional microfibrils. The microfibrils, like the fibrils, do not appear to be constant in width, but to vary from a few hundred to about a thousand Angstrom units. Although the microfibrils are roughly parallel to the long axis of the cell, they do not present a picture comparable to a pile of matches in parallel alignment. They are observed rather,

Fig. 5—Parts of scales removed mechanically from fibers.
(a) Thin sliver of scale obtained from fiber by scraping.
(b) Piece of scale chipped off during passage of fiber through a Wiley mill. (The completely opaque parts of the micrograph are due to thick fragments of the cortex which cling to the scale.)
Electronmicrograph x 16,500

Fig. 6—Cortical cells from treated wool.
(a) Single cell, showing the nucleus, and the fibrillate appearance of the rest of the cell. Stained with Orange II.
(b) Single cell, between crossed nicols, showing the non-birefringent nucleus in the birefringent cells.
Photomicrograph x 1500



to coalesce, so that apparent spaces of various sizes up to several tenths of a micron are formed between them. Adjacent fibrils are connected by other microfibrils which, however, have a much looser texture. In other words there are more microfibrils per unit area in the dense regions (fibrils) than in the less dense regions (interfibrillar regions) of the cortical cell.

The structural details revealed by the electron microscope make possible a clearer interpretation of previously-observed phenomena. It seems likely, for example, that when cortical cells are dissected by means of microneedles, the needles first penetrate the interfibrillar regions, where the microfibrils are more easily disrupted than in the compact fibrils. Upon further manipulation, the interfibrillar regions are apparently torn longitudinally, thereby separating the fibrils. Also, as previously pointed out, the cortical cells are birefringent in the polarizing microscope (figure 6,b). They are not, however, uniformly bright, but show alternate striations of high and low birefringence which appear to correspond to the fibrils and interfibrillar regions. From the present work with the electron microscope the fibrils might be expected to show greater brightness between crossed nicols because of the greater compactness of their microfibrils, as compared with those in the interfibrillar regions. It should be borne in mind, however, that the light areas recorded on the micrographs, and which are especially abundant in the interfibrillar regions, do not necessarily indicate open spaces, but may only indicate areas which contain a material that is less dense than the surrounding microfibrils.

Upon examining the specimens from reduced and methylated wool in the optical microscope, before and after their exposure to the electrons, there was no evidence that the cortical cells had been adversely affected by the electrons. Similarly, micrographs taken with the first flow of electrons through a specimen did not appear to differ from subsequent micrographs taken after longer bombardment. The behavior of cells from wool which had not been reduced was, however, quite different. Just as soon as the beam of electrons struck these specimens pronounced changes in structure occurred. The cells literally exploded, and assumed a characteristic appearance (figure 9). In the optical microscope the bombarded cells looked dark, charred, and distorted. This behavior, which is not uncommon with thick sections of organic materials (32), has been described previously in the cotton fiber (33, 34).

The differences in reaction of the cells from untreated and from treated wool to bombardment by electrons make it interesting to speculate on the causes of this phenomenon. Since the specimens of wool used in this phase of the work were identical except for the reduction and methylation treatment, it seems probable that this treatment may account for the observed behavior.

Because of the thickness and density of the cortical cells, it may be expected that under bombardment by the electrons a large amount of energy would be absorbed, and this, in turn, would tend to disorganize the keratin. The

Fig. 7—(a) and (b) Parts of cortical cells from treated wool, showing separation of the fibrils into still smaller microfibrils. Electronmicrograph x 16,000

foamy appearance of the disorganized cells suggests, moreover, that the decomposition may be accomplished by the evolution of gases. Consequently, a certain degree of breakdown might be expected to occur in cells from both the untreated and from the treated wool. However, in untreated wool the close alignment of the keratin molecules does not, presumably, permit the gases to diffuse readily, and as a result the cell explodes. The looser arrangement of the molecular chains in reduced and methylated wool, on the other hand, apparently allows diffusion to take place more easily and consequently disintegration does not occur. Also, in preparing the treated wool the disulfide cross linkages are ruptured (reduced) and then methylated to prevent their re-formation. This may impart to the long polypeptide chains more freedom of movement when subjected to mechanical forces. In untreated wool, on the other hand, the original cross-linkages remain intact and thereby hold the keratin chains in rather rigid alignment.*

*Stress-strain measurements indicate that reduced and methylated fibers are capable of greater elongation than untreated fibers (35).

Fig. 8—Part of cortical cell showing fibrils and microfibrils.
Electronmicrograph x 26,500

Fig. 9—Part of a cortical cell disorganized by the electrons.
Electronmicrograph x 17,000

Fig. 10—Part of cortex obtained by mechanical action. Portion of a cell showing microfibrils.
Electronmicrograph x 20,000

Although both scale and cortical cells from untreated wool usually underwent disintegration by the electrons, occasionally scales were not disorganized (compare figures 4,a and 4,b). In these instances, presumably, the specimens were thin enough so that the electrons could pass through without disturbing the molecular architecture of the cell.

Additional explanations for the differences in behavior of these samples of wool during bombardment may also be suggested. It is possible, for instance, that the treatment with pepsin removed from the reduced and methylated wool some substances, thereby increasing the porosity of the treated wool as compared with the untreated wool. This difference in porosity might account for the observed differences in reaction. Similarly, the temperature at which disintegration of the specimens occurs may be lower for untreated than for treated wool, and this may be another explanation of the phenomenon. However, regardless of the specific reasons for the unlike behavior of these specimens in the electron microscope it is instructive to note that besides the differences which these wool fibers show in alkali-solubility, in mechanical properties, and in susceptibility to attack by enzymes and microorganisms, there is also this additional difference in the reaction of their component cells when exposed to electrons.

Cortical material which had received no specific chemical treatments, but which was prepared by trituration as previously described, was also examined for comparison with the cells which were released from wool by chemical action. Again, it was found that the cortex is made up of a highly fibrous material. Because the sections were prepared by

rather drastic mechanical action, and also because the plane of the sections is uncertain, a detailed interpretation of the micrographs is difficult. However, figure 10 shows, apparently, innumerable interlocking and variously-aggregated microfibrils, and thereby gives further evidence of the fibrous nature of the cortical cells.

There is abundant evidence from chemical, physical, and microscopic studies in support of a fundamental fibrous structure of textile fibers, and to this knowledge the present investigation of wool gives additional support. Whereas with the optical microscope only fibrils may be observed within the cortical cells the electron microscope resolves still finer microfibrils. It is important to note, that studies with the electron microscope support previous evidence which indicates that only the cortex and not the cuticle appears to have a fibrous structure.

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OIL IN TEXTILE PLANT BOILER FEED

W. F. Schaphorst, M.E.

ON a number of occasions I have been asked whether or not there is a device on the market that indicates directly the quantity of oil in boiler feed water.

So far as I know, there is not. Without question such an "oil indicator" would be of much value and the inventor would do well to let the world know about it. Unlike the maker of Emerson's famous mouse trap, the world will *not* build a path to the door of the inventor of an oil indicator unless he makes it known in some way or other that he has such a device to sell.

In view of the lack of a real "oil indicator," I should say that the most practicable way in which to determine the presence of oil with ordinary standard equipment is to install a good feed water filter in the line. Place a pressure gauge ahead of the filter and another gauge behind it so that the pressure drop through the filter can be observed at all times. When clean it will be found that the pressure drop is light. As oil accumulates in the filter cloths the pressure drop increases. A curve can be plotted between time and dirtiness, based on the pressures, which will enable one to know with surprising exactness the amount of oil in the cloths at any time after installation.

If the filter is a good one—that is, if it extracts *all* of the oil, as it should, the exact amount of oil can be determined by weighing the cloths while dirty and then when clean. The difference in weights, of course, is the weight of the oil.

•CLASSIFIED• ADVERTISEMENTS

The rate for "Position Wanted" advertisements in this column is 2 cents a word—with a minimum of 50 cents per insertion. For all other types of advertisements—i.e., help wanted, machinery or supplies for sale—the rate is $6.25 per column inch or less per insertion.

POSITION WANTED: Hosiery Dyer. 17 years' experience covering all types of dyes and a wide variety of fabrics. Draft exempt. Write Box No. 474, American Dyestuff Reporter, 440 Fourth Ave., New York, 16, N. Y.

Back the Attack!

BUY

WAR BONDS!

BOTTOM FOR YOUR NAVY BLUES!

Alizarine Red has been used for years by successful manufacturers to give depth to their indigo dyeings.

Today they are finding Calco Alizarine Red Paste the same reliable color for this purpose as always, unchanged by the greater demands created by the huge increase in Navy procurements.

A sound source for over twenty years, Calco production today is ample to meet your expanded needs.

CALCO CHEMICAL DIVISION
AMERICAN CYANAMID COMPANY
BOUND BROOK, NEW JERSEY

BOSTON PHILADELPHIA PROVIDENCE
NEW YORK CHICAGO CHARLOTTE

The Moon is Down...

THERE are dark nights in Norway. Nights when Nazi sentries feel uneasy at their posts.

It is not what they hear that disturbs them. It is what they do *not* hear. The deep silence behind a bush. The stealthy quiet around the corner of a house. The terrible hush in the blackness all around them.

For the Norwegians lost their country without ever surrendering themselves. They wait now in the night to strike back at their oppressors.

If they ever *had* really given in, there would be no need of the thousands of Nazi troops now in Norway. They could have been sent to the Russian front. Or to face an Allied invasion. *But they couldn't be spared.*

They can't be spared in Holland either. Or Poland or France or Yugoslavia or Belgium. In China, tens of thousands of Jap troops must also remain. And Axis troops will have to remain in countless countries so long as the "conquered" people have the stamina to resist.

You can help support *this army already in Europe*—by your contribution to the National War Fund, which you make through our community's own war fund.

For this year, the agencies that can do this job have banded together to make the collection and distribution of funds simpler, cheaper and more effective. Their job is threefold. To keep our fighting allies in the fight. To provide friendly help for our men in the armed services. And to relieve distress where it is found here on the home front.

Because all these agencies are now banded together, you are being asked to contribute only *once* for *all* of them. Because you are being asked to give only *once,* you are also being asked to give *generously.* Add up all you would have given to each of these agencies throughout the year, and then *double the total!* It is one of the most important contributions you can make to victory!

Give ONCE for ALL these

USO
United Seamen's Service
War Prisoners Aid
Belgian War Relief Society
British War Relief Society
French Relief Fund
Friends of Luxembourg
Greek War Relief Association
Norwegian Relief
Polish War Relief
Queen Wilhelmina Fund
Russian War Relief
United China Relief
United Czechoslovak Relief
United Yugoslav Relief Fund
Refugee Relief Trustees
United States Committee for the Care of European Children

NATIONAL WAR FUND

How Would You Like To Talk About Your Products To More Than 4800 Chemists, Dyers and Finishers At One Time?

The Eighth Annual Processing Review Number of the AMERICAN DYESTUFF REPORTER will be published on November 22nd, to permit the publication in one issue, of all papers which were prepared by the various local sections in competition for the Inter-Sectional contest award sponsored by the Association, as well as information on new machinery, chemicals, dyestuffs and synthetics developed during 1943.

★ The publication of these original papers will be of great interest to the chemist, dyer and finisher in the textile wet processing industry, as subjects will be pertinent to today's problems. Therefore, the value of display advertising is definite.

★ As a manufacturer of products which are important in the production of fabrics for war, you should certainly request advertising space reservations in this annual issue.

To assure good position, please wire or write today.

AMERICAN DYESTUFF REPORTER
440 Fourth Avenue, New York

LeaTex

CHEMICAL
SPECIALTIES
for the
TEXTILE INDUSTRY

"Always Reliable"

LEATEX CHEMICAL COMPANY
2722 N. HANCOCK ST., PHILADELPHIA, PA.

AQUAKAL No. 73, for quick wetting out of ducks for mineral or vat dyeing. Excellent for re-wetting for sanforizing, also for penetration of dyes or wetting of piece goods, skeins, package or raw stock.

AQUAKAL No. 74, for pasting vat dyes.

HYDROXY* WATER-SHIELD, to meet U. S. Government specifications, with or without approved mildewproof.

HYDROXY MILDEWPROOF No. 2—Approved by U. S. Army Corps of Engineers to meet tentative specification T-1452A.

HYDROXY SIZES for filament or staple yarns, viscose, acetate or Bemberg.

HYDROXY TREATMENTS for viscose or acetate knitting yarns, in skein or by roller in trough.

SULPHONATED OILS—Finishes, boil-off and scouring oils.

*(Reg. U. S. Pat. Off.)

Kali
MANUFACTURING CO.
Manufacturing Chemists
1410 NO. FRONT ST. PHILADELPHIA 22, PA.

Exact Weight Scales

Shadowgraph for Perfect Blending . . .

Exactness in color blending can best be obtained by skilled careful predetermined weighing. No industrial scale yet created can do the task with greater precision plus speed than EXACT WEIGHT Shadowgraph . . . a weighing unit with extremely high sensitivity and accuracy. An illuminated dial rules out errors from bad light . . . weights are furnished to specifications for the operation.
Write for full details for your operation.

SHADOWGRAPH . . . an electrically operated weighing unit for color control, formulae compounding and batch mixing in Dyehouses.

THE EXACT WEIGHT SCALE CO.
13 W. Fifth Ave. Columbus 8, Ohio
Dept. H, Toronto, Canada

SURE!

When you use DIASTAFOR de-sizing agent you are *sure* of getting top-notch de-sizing and finishing results. 35 years of satisfactory service stand behind this famous choice of the textile world.

DIASTAFOR-treated fabrics are smooth, supple, flawless. They meet every eye and touch test. DIASTAFOR's high quality, strength and color never vary.

Be *sure* — with DIASTAFOR. See our technical man or write to —

FLEISCHMANN'S DIASTAFOR
Standard Brands Incorporated
DIASTAFOR DIVISION
40 Worth Street New York, N. Y.

DIASTAFOR
35 Years of Satisfactory Results

DEPENDABLE PRODUCTS FOR THE TEXTILE TRADE

ESOTOO* — "The Ideal Antichlor"

"Esotoo" — Virginia's Trade Name for Liquid Sulfur Dioxide—has become the textile industry's No. 1 antichlor. Its adaptability has been vastly increased by the introduction of Virginia's semi-self-controlled method of regulating SO_2 concentrations in the sour box. Saves washing time; cuts water consumption and chemical costs to a new low.

HYDROSULFITE SOLUTIONS

The preparation of hydrosulfite solutions (zinc or sodium) is a simple and practical procedure using formulae and equipment supplied by "Virginia". The money-saving advantages of these low-cost solutions for stripping, decolorizing and indigo reduction will be especially interesting to the large scale operator.

NEW!
VIRGINIA SODIUM HYDROSULFITE POWDER

Virginia Sodium Hydrosulfite is a white, free-flowing, uniformly crystalline powder, combining extraordinary stability with a high reduction factor. Excellent stability prevents loss of efficiency during shipment and storage: high solution efficiency assures effective reduction of vat colors — dependable decolorizing and stripping results.

BUY WAR BONDS & STAMPS

Back of every Virginia product and process, is Virginia's staff of experienced technical men — men with "know-how" skill available for consultation concerning your decolorizing, antichlor or dye reduction problems. What is your problem?

VIRGINIA

*"ESOTOO" is Virginia's Trade name for Liquid Sulfur Dioxide.

VIRGINIA SMELTING CO.
WEST NORFOLK, VIRGINIA

•MORE WEAR
•LESS STRETCH
•BETTER FIT

with Laurel Rayon Oils

PROPER FINISHING is a rayon requisite in spite of the need for speed in wartime production. Laurel Rayon Oils actually save production time. Laboratory and mill tested, they offset rayon weaknesses by improving lubrication, effecting gain in resiliency with resultant longer wear and better fit.

Laurel Rayon Oils and Finishes are available for immediate delivery. Our Laboratory stands ready to cooperate with you on special purpose compounds. Send for trial order today.

★

SPEED VICTORY—BUY BONDS

SOAPS • OILS • FINISHES
Laurel
SOAP MANUFACTURING CO·INC·

WM. H. BERTOLET'S SONS ESTABLISHED 1909
TIOGA, THOMPSON & ALMOND STS., PHILADELPHIA, PA.
WAREHOUSES: PATERSON, N. J., CHATTANOOGA, TENN., CHARLOTTE, N. C.

CHEMICALS BY GLYCO

FLAMEPROOFING AGENTS
WATERPROOFING AGENTS
AND OTHER SPECIALTIES FOR
THE TEXTILE INDUSTRY

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Write for our Catalogue
"Chemicals by Glyco"
GLYCO PRODUCTS COMPANY, INC.
26 Court St., Brooklyn 2, New York

RAPIDASE
THE STANDARD DE-SIZING AGENT
for cottons, rayons and mixed goods

For your de-sizing problems—
our technical men are at your
service . . . Write or 'phone.

WALLERSTEIN COMPANY, INC.
180 MADISON AVENUE, NEW YORK

Manufacturers of Dyestuffs and Chemical Specialties

We offer to the Textile and Allied Trades
a full line of

DYESTUFFS DYEWOODS
CHEMICAL SPECIALTIES

The experience gained through many years of manufacturing quality products, progressive research policies and the faith of our customers allow us to face the present emergencies with confidence.

As in the past, we are prepared to help you with any manufacturing problems you may have. We place our experience and our research facilities at your disposal.

MAY WE SERVE YOU?

COMMONWEALTH COLOR & CHEMICAL CO.
MAIN OFFICE AND WORKS: Nevins, Butler and Baltic Streets, Brooklyn, N. Y.
Philadelphia • Chicago • Charlotte • Gloversville • Kansas City • Montreal

Textiles have become weather conscious

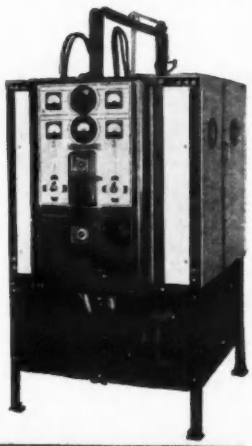
Mill operators know what the ATLAS FADE-OMETER and LAUNDER-OMETER have done for the industry in predetermining the fastness to light and washing of textiles.

ATLAS TWIN-ARC WEATHER-OMETER

for years the standby of the paint and roofing industry, now has been redesigned to accommodate large size textile specimens in order to meet the new federal specifications demanding accelerated tests.

Atlas Twin-Arc Weather-Ometers alone have—

1. Temperature control.
2. Unlimited range and control of Light and Water Spray Periods.
3. Adjustable and automatic timing.
4. Insulated test chamber.
5. Operates continuously 24 hours without manual attention.
6. Carbons 28c per day.
7. Full automatic—Safe to operate unattended overnight.
8. Control panel contains all the essential meters and automatic timers required to perform the functions of the machine.



• Originators and sole manufacturers of accelerated testing devices for a quarter of a century. Fade-Ometer, Weather-Ometer, Launder-Ometer are the accepted standard accelerated testing machines all over the world.

ATLAS ELECTRIC DEVICES CO.
361 W. Superior St.,
Chicago 10, Illinois

ATLAS-OMETERS
WEATHER-OMETER
LAUNDER-OMETER ★ FADE-OMETER

★ Invest In The Future of *Your* Country! ★

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TRADE MARK REG. U. S. PAT. OFF.

Suppliers of LIQUID CHLORINE

SOLVAY SALES CORPORATION
Alkalies and Chemical Products Manufactured by The Solvay Process Company
40 RECTOR STREET **NEW YORK, N. Y.**

BRANCH SALES OFFICES:
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4 STAR PRODUCTS for PROCESSING MILITARY FABRICS

FUNGICIDE G

To meet government specifications for mildewproofing sleeping bags, webbing, tentage, shoe linings, tapes, mosquito netting, etc. . . non toxic . . non irritating.

ARKO FIRE RETARDANT

For flameproofing uniform cloth, tentage, felts, etc.

AQUAROL*

Produces a water-repellent finish on uniform cloth, overcoatings, and other military fabrics . . . used in a single bath treatment with Fungicide G to impart water-repellency and mildew resistance . . . used in a single bath treatment with Arko Fire Retardant to produce water-repellency and fire-resistance.

CULOFIX L*

For preventing color-bleed in water of direct dyed cotton.

*Reg. U.S. Pat. Off.

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MANUFACTURERS OF AC INDUSTRIAL CHEMICALS

NEWARK NJ NEW JERSEY

Established for over 38 years

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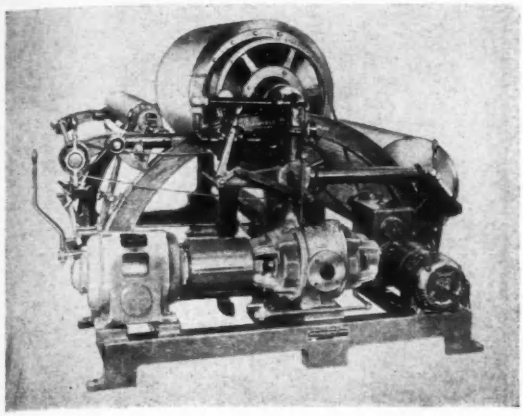

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Improvements made in these fine machines since 1937, when they were first introduced, add to their simplicity and efficiency of operation.

Due to the simplicity of this single-cylinder machine, only one operator is required. Yet in actual test with competitive machines requiring two operators, this Van Vlaanderen machine produced 250 yards more per hour with only one operator. This test was made by a regular finishing plant, on its own initiative, with an impartial desire to learn the facts.

Decating on this machine results in a mellower hand, absence of breaks and cracks, duller, more pleasing appearance, more uniform cloth, and clearer dyed shades.

This is the machine you will want to meet post-war competition. Care for it, if you have one. Fit it into your future plans if you cannot have it now.

Each Van Vlaanderen Decater is complete ready for use as soon as given steam, water and power connections in your plant.

Full facts gladly furnished

VAN VLAANDEREN MACHINE CO.

370 STRAIGHT STREET, PATERSON, N. J.

World's largest manufacturers of synthetic fabric processing machinery

TEXTILES' VITAL ROLE IN WINNING THE WAR
(NO. 6 OF A SERIES)

CITATION

FOR A *Home Front* HERO

Though the civilian wins no medals for valor, let us pay him tribute here. For he is well acquainted with courage and sacrifice and steadfastness. Every hour of the day, new demands are made on his energy and skill. While he is on the job in factory, farm and office, America's mills are working hard under great difficulties to supply him with textiles that satisfy his varied needs.

In the vital work of the textile industry, Burkart-Schier is playing an active part. For Burkart-Schier technicians and textile chemicals are working right along with the country's mills, helping to process all sorts of fabrics, giving them needed characteristics, making fabrics fit to fight, here at home, as well as at the front.

BURK-SCHIER

BURKART-SCHIER CHEMICAL CO.

Manufacturing Chemists for the Textile Industry

CHATTANOOGA, TENNESSEE

PENETRANTS • DETERGENTS • SOFTENERS • REPELLENTS • FINISHES

Army Supplies Float in Textile Bags

How to carry clothing and dehydrated foods through jungle streams was a problem for the Army—but not for long.

Waterproof bags designed by the Quartermaster Corps protect supplies in the most humid climate. Compact and light in weight, easy to carry, yet give complete protection when thoroughly wet during the fording of a stream.

There is one bag for clothes . . . another for foods. Both are made of a tough, weatherproof sheeting fabric. A flat-braided cotton tie cord is used to close the bag.

Mills making fabrics for the new waterproof bags depend on Butterworth Machines at every step in the Wet End of Textile Finishing.

Butterworth Machines are playing their part in the battle of production—bleaching, boiling-out, drying, calendering, dyeing.

Butterworth engineers freely offer their cooperation to mills seeking to achieve increased productive efficiency . . . or to repair or replace worn-out or obsolete equipment.

All of our facilities not required for Ordnance production are available to help you solve your problems. Let us serve you now.

H. W. BUTTERWORTH & SONS CO.
Phila. 25, Pa. Serving Textile Industry since 1820
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***64%**

of equipment now in use in the wet end of textile finishing cannot operate at a profit in competition with modern machines.

*Proved by Research

Butterworth

PRODUCING GUN MOUNTS FOR THE UNITED STATES ARMY

For over 35 years, much of
milady's apparel has been processed
with Scholler products . . . hosiery, gloves,
blouses, skirts and underthings—all have
been enriched in beauty and increased in service life.
And, for every fibre available today, there is a
DURABEAU* FINISH "tailored to fit the fabric."

DuraBeau FINISHES
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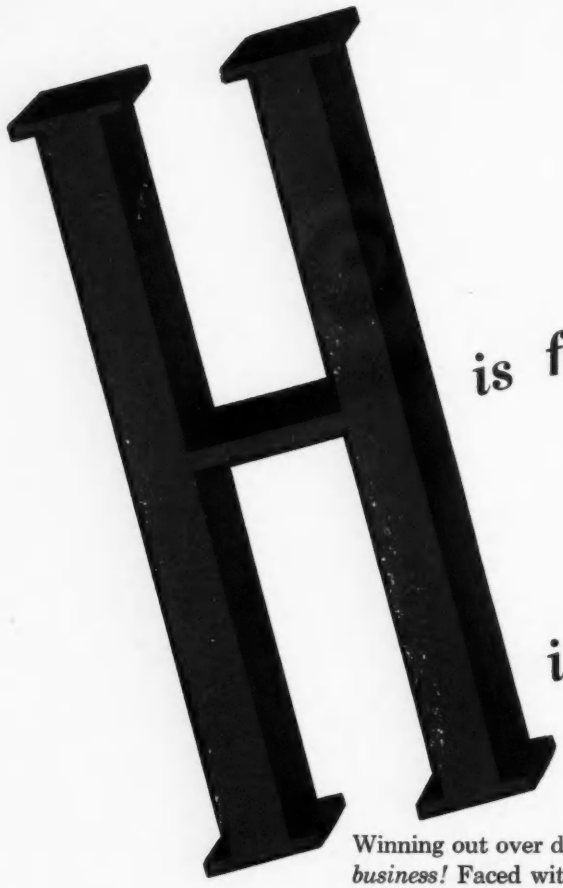
SCHOLLER BROS., INC. Mfrs. of Textile Soaps, Softeners, Oils, Finishes • Collins & Westmoreland Sts., Phila. 34, Pa. • St. Catharines, Ont., Can.



H is for ~~HANDICAPS~~ . . .

H is for HELPFULNESS

Winning out over difficulties is both typically American in spirit . . . *and good business!* Faced with war-made shortages of many chemicals formerly considered essential to their production, many manufacturers are finding that they can make the best of the situation by making the most of Cyanamid's timely developments in non-critical replacement materials.

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We will be glad to work with you on the solution of your problem. There is no obligation.

AMERICAN CYANAMID
& CHEMICAL CORPORATION
(A Unit of American Cyanamid Company)
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MANUFACTURERS OF
SULPHONATED OILS • PENETRANTS • FINISHES • SOFTENERS
SIZING COMPOUNDS • DECERESOL* WETTING AGENTS
AND OTHER SPECIALTIES FOR THE TEXTILE INDUSTRY
*Reg. U. S. Pat. Off.

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